

THE
PAN-PACIFIC ENTOMOLOGIST



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No. 1

Synonymy in Coniontini

(Coleoptera: Tenebrionidae)

John T. Doyen

University of California, Berkeley 94720

The tribe Coniontini includes approximately 200 named species of beetles in Western Canada and United States, Mexico, and Central America. The great majority of names are presently assigned to two large genera, *Eusattus* LeConte and *Coniontis* Eschscholtz (see Doyen, 1972). Most species in these genera were described by Thomas L. Casey, who perceived minor differences in cuticular sculpturing or body proportions as species defining characteristics. The plethora of names is so great, especially in *Coniontis*, that it is impossible to identify most specimens, even with determined comparison material. The changes specified here are intended to simplify the check list being compiled for the North American Beetle Faunal Project, and are based primarily on study of types in the Casey Collection of the United States Museum of Natural History and in the LeConte and Horn Collections of the Museum of Comparative Zoology, Harvard University.

Because of the complex nature of infraspecific variation in many of these beetles, further studies will probably reveal additional synonymy. The status of a few names can be determined only by examination of pertinent types. For example, *C. affinis* LeConte (and its numerous junior synonyms) is probably synonymous with *C. eschscholtzi* Mannerheim, but the type of the latter has not been examined.

Lectotypes for the species described by Casey have never been designated, but "types" were chosen by Buchanan (Buchanan, 1935; Spilman, 1959). Unless indicated otherwise, the specimens selected by Buchanan are here regarded as types. Similarly, the LeConte and Horn specimens bearing type labels are regarded as types. *Conisattus*, incorrectly assigned to *Coniontis* (Doyen, 1972) properly belongs in *Eusattus* (**NEW SYNONYMY**). In other respects the generic composition of the Coniontini corresponds to that of Triplehorn (1968) and Doyen (1972). For each species the oldest name and type locality are mentioned first, followed by an alphabetical listing of synonyms. All synonymy is new.

The financial assistance of the National Science Foundation (Grant Number BMS74-17924) is gratefully acknowledged. Paul A. Rude and Edward Rogers assisted with the research.

Coniontis abdominalis LeConte

- Coniontis abdominalis* LeConte 1859:77. Tejon, Kern County, California.
Coniontis gravis Casey 1908:85. Monterey, Monterey County, California.
Coniontis rugosa Casey 1908:85. No collection locality.
Coniontis strenua Casey 1908:84. S. Barb. (Santa Barbara, California).
Coniontis tenebrosa Casey 1908:86. Santa Barbara, California.
Coniontis tristis Casey 1908:84. Los Angeles County, California.

Coniontis affinis LeConte

- Coniontis affinis* LeConte 1851:130. Benicia, Solano County, California.
Coniontis audax Casey 1908:121. California.
Coniontis anxia Casey 1908:123. California.
Coniontis convergens Casey 1908:122. California.
Coniontis expansa Casey 1908:120. San Francisco, California.
Coniontis franciscana Casey 1908:120. Vicinity of San Francisco, California. *Coniontis expansa franciscana* Papp 1961:117.
Coniontis oregona Casey 1908:124. Albany, Linn County, Oregon.
Coniontis pagana Casey 1908:130. California. *Coniontis eschscholtzi pagana* Papp 1961:117.
Coniontis affinis patruelis Casey 1908:123. California.
Coniontis suturalis Casey 1908:121. California.
Coniontis symmetrica Casey 1908:122. Vicinity of San Francisco, California.
Coniontis truncata Casey 1908:120. Benicia, Solano County, California.
Coniontis affinis occurs in maritime habitats from Oregon to Point Conception, Santa Barbara County, California. Individuals from northerly localities are slightly more rugose and have more evident setae than those from southern localities, but the overall variation in this species is not great. Casey's numerous species are based partly on secondary sexual characters especially stoutness of the body, and partly on minor differences in elytral and pronotal sculpturing. *Coniontis affinis* is probably synonymous with *C. eschscholtzi* Mannerheim, as noted by Horn (1870).

Coniontis callida Casey

- Coniontis callida* Casey 1908:128. No collection locality.
Coniontis agrestis Casey 1908:131. California.
Coniontis conferta Casey 1908:129. Sisson (= Mt. Shasta), Siskiyou County, California.
Coniontis congesta Casey 1908:131. California. *Coniontis eschscholtzi congesta* Papp 1961:117.
Coniontis shastanica Casey 1908:128. Siskiyou County, California.

Coniontis elliptica Casey

- Coniontis elliptica* Casey 1884:46. San Diego, San Diego County, California.
Coniontis cuneata Casey 1908:111. San Diego, San Diego County, California.
Coniontis laevigata Casey 1908:88. Kern County, California.
Coniontis elliptica catalinae Casey 1908:88. Catalina Island, Los Angeles County, California.

Coniontis elongata Casey

- Coniontis elongata* Casey 1890:99. Benicia, Solano County, California.
Coniontis cylindrica Casey 1908:100. California.
Coniontis innocua Casey 1908:99. No collection locality.
Coniontis limatula Casey 1908:99. California.
Coniontis longicollis Casey 1908:101. Texas.
Coniontis obsidiana Casey 1908:100. Santa Barbara (Santa Barbara County), California.
Coniontis rotundicollis Casey 1908:97. California.

The type locality for *C. longicollis* is certainly erroneous; the holotype is probably from northern California.

Coniontis extricata Casey

- Coniontis extricata* Casey 1908:124. California.
Coniontis marginata Casey 1908:125. San Francisco, California.
Coniontis minuta Casey 1908:126. San Francisco County, California.
Coniontis parva Casey 1908:126. California.
Coniontis perpolita Casey 1908:127. California.
Coniontis pudica Casey 1908:127. Vicinity of San Francisco, California.
Coniontis nemoralis slevini Blaisdell 1924:87. Point Lobos, Monterey County, California.

Coniontis extricata and its synonyms are probably equivalent to *Coniontis nemoralis* Eschscholtz (1829) but the type of *nemoralis* has not been examined.

Coniontis genitiva Casey

- Coniontis genitiva* Casey 1890:385. Lake County, California.
Coniontis opacicollis Casey 1908:101. No collection locality.
Coniontis verna Casey 1908:94.

Coniontis lassenica Casey

- Coniontis lassenica* Casey 1908:95. Amedee, Lassen County, California, 4200 ft.
Coniontis nevadensis Casey 1908:95. Nevada.
Coniontis carsonica Casey 1908:95. Carson City, Ormsby County, Nevada.

Coniontis lata LeConte

- Coniontis lata* LeConte 1866:113. San Clemente (Island, Los Angeles County, California).
Coniontides clementinus Casey 1908:80. San Clemente Island, California.
Coniontides finitimus Casey 1908:79. California.
Coniontides insularis Casey 1890:377. Santa Cruz Island, Santa Barbara County, California.

Coniontis microsticta Casey

- Coniontis microsticta* Casey 1908:107. Alameda County, California.
Coniontis inconspicua Casey 1908:108. California.

Coniontis obesa LeConte

- Coniontis obesa* LeConte 1851:131. No collection locality.
Coniontellus ampliatus Casey 1908:144. Reno, Washoe County, Nevada.
Coniontellus argutus Casey 1908:145. Bodie, Mono County, California.
Coniontellus hystrix Casey 1908:142. Reno, Washoe County, Nevada.
Coniontellus inflatus Casey 1890:389. Reno, Washoe County, Nevada.
Coniontellus longipennis Casey 1908:143. Reno, Washoe County, Nevada.
Coniontellus micans Casey 1908:145. Buena Vista, Chaffee County, Colorado, 7,900-8,000 ft.
Coniontellus subglaber Casey 1908:144. Helena, Lewis and Clark County, Montana.

Coniontis opaca Horn

Coniontis opaca Horn 1870:296. California.

Coniontis ancilla Casey 1908:91. San Bernardino County, California.

Coniontis degener Casey 1908:93. No collection locality.

Coniontis ovalis LeConte

Coniontis ovalis LeConte 1851:131. Oregon (?).

Coniontis acerba Casey 1908:139. Bitter Root (Bitter Root Mtns.), Montana.

Coniontis alutacea Casey 1890:383. Reno, Washoe County, Nevada.

Coniontis anita Casey 1908:139. Boulder County, Colorado.

Coniontis arida Casey 1908:138. Utah.

Coniontis breviscula Casey 1908:133. Probably from vicinity of Puget Sound, Washington.

Coniontis corvina Casey 1908:140. Boulder County, Colorado.

Coniontis inepta Casey 1908:137. Salida, Chaffee County, Colorado.

Coniontis oblita Casey 1908:137. Probably from Idaho.

Coniontis ovalis okanagani Boddy 1957:157. Cascade, British Columbia.

Coniontis parilis Casey 1908:135. Victoria, British Columbia.

Coniontis punctata Casey 1908:135. No collection locality.

Coniontis regularis Casey 1908:134. Leavenworth, Chelan County, Washington.

Coniontis sculptipennis Casey 1908:134. Washington.

Coniontis uteana Casey 1908:136. Nephi, Juab County, Utah.

Coniontis vancouveri Casey 1908:136. Victoria, British Columbia.

Coniontis weidti Casey 1908:138. Utah.

Coniontis ovalis exhibits considerable geographic variation of a clinal nature. Individuals from the Pacific Northwest have strongly rugose elytra. South through Idaho the sculpturing becomes gradually finer, and specimens from Colorado and southern Utah are more punctate than rugose. *C. o. okanagani* Boddy, from interior British Columbia and Washington, is similar to *acerba* Casey and *oblita* Casey.

Coniontis pallidicornis Casey

Coniontis pallidicornis Casey 1890:385. California.

Coniontis obsolescens Casey 1908:92. California.

Coniontis parviceps Casey

Coniontis parviceps Casey 1890:387. San Diego, San Diego County, California.

Coniontis filiola Casey 1908:115. Poway, San Diego County, California.

Coniontis pectorallis Casey

Coniontis pectorallis Casey 1908:86. California.

Coniontis levettei Casey 1908:87. California.

Coniontis pisescens Casey 1908:87. No collection locality.

Coniontis puncticollis LeConte

Coniontis puncticollis LeConte 1851:131. Benicia, Solano County, California.

Coniontis exigua Casey 1908:106. Vicinity of San Francisco, California.

Coniontis inflexula Casey 1908:107. Vicinity of San Francisco, California.

Coniontis pauperula Casey 1908:106. California.

Coniontis picipes Casey 1908:107. California.

Coniontis punctulata Horn

Coelotaxis punctulata Horn 1876:201. California.

Coelotaxis angustula Casey 1889:177. Guadalupe Island, Mexico.

Coelotaxis densa Casey 1908:149. Guadalupe Island, Mexico.

Coelotaxis frontalis Casey 1908:149. Guadalupe Island, Mexico.

Coelotaxis muricata Horn 1876:201. California.

Coniontis robusta Horn

Coniontis robusta Horn 1870:296. California.

Coniontis luctuosa Casey 1908:89. Pomona Mtns., California.

Coniontis setosa Casey

Coniontis setosa Casey 1890:387. Idaho.

Coniontis lanuginosa Casey 1908:117. Carson City, Ormsby County, Nevada.

Coniontis obtusa Casey 1908:116. Clear Lake, Millard County, Utah.

Coniontis pubifera Casey 1908:118. W. T. (Washington?).

Coniontis wickhami Casey 1908:117. Marysvale, Piute County, Utah.

Coniontis subpubescens LeConte

Coniontis subpubescens LeConte 1851:131. Probably from San Jose, Santa Clara County, California.

Coniontis canonica Casey 1908:114. California.

Coniontis montana Casey 1890:384. Vicinity of Lake Tahoe, California.

Coniontis timida Casey

Coniontis timida Casey 1908:102. Vicinity of San Francisco, California.

Coniontis conicollis Casey 1908:102. Vicinity of San Francisco, California.

Coniontis lucidula Casey 1908:103. California.

Coniontis protensa Casey 1908:104. Berkeley, Alameda County, California.

Eusattus convexus LeConte

Eusattus convexus LeConte 1851:132. Kansas Territory.

Eusattus acutus Casey 1908:74. Logan County, Kansas.

Eusattus peropacus Casey 1908:74. Kansas.

Eusattus quadratus Casey 1924:311. Roswell, Chavez County, New Mexico.

Eusattus rotundus Casey 1908:72. North of Fort Collins, Larimer County, Colorado.

Eusattus subvelutinus Casey 1924:312. Roswell, Chavez County, New Mexico.

Eusattus turgidus Casey 1908:73. Kansas.

Eusattus woodgatei Casey 1924:312. New Mexico.

Eusattus difficilis LeConte

Eusattus difficilis LeConte 1851:132. San Diego (?), California.

Eusattus acutangulus Casey 1908:72. Colorado.

Eusattus agnatus Casey 1908:70. Los Angeles County, California.

Eusattus compositus Casey 1908:71. Oregon.

Eusattus congener Casey 1908:71. New Mexico.

Eusattus coquilletti Linell 1899:180. Los Angeles County, California.

Eusattus dilatatus LeConte

Eusattus dilatatus LeConte 1851:132. California. *Sphaeriontis dilatata* Casey 1908:76.

Coelosattus fortineri Blaisdell 1927:167. Gray's Well, near Yuma, Imperial County, California. *Eusattus fortineri* LaRivers 1969:4; Doyen 1972:373.

Eusattus dubius LeConte

Eusattus dubius LeConte 1851:132. California. *Conipinus dubius* LeConte 1862:223.

Eusattus nanus Casey 1895:613. Kern County, California.

Eusattus oblongulus Casey 1908:67. Lancaster, Los Angeles County, California.

Eusattus spauldingi Casey 1924:313. Las Vegas, Clark County, Nevada.

Eusattus muricatus LeConte

- Eusattus muricatus* LeConte 1851:132. Oregon. *Sphaeriontis muricata* Casey 1908:75.
Sphaeriontis acomana Casey 1908:76. New Mexico.
Sphaeriontis fulvescens Casey 1924:310. Lone Pine, Inyo County, California.
Sphaeriontis latissima Casey 1924:310. Palm Springs, Riverside County, California.

Eusattus nitidipennis LeConte

- Eusattus nitidipennis* LeConte 1851:132. Mexico.
Eusattus brevis Champion 1884:75. Esperanza, Puebla, Mexico.

Eusattus productus LeConte

- Eusattus productus* LeConte 1858:20. Arizona.
Eusattus explanatus Casey 1908:68. California.
Eusattus lobatus Casey 1908:68. Arizona.
Eusattus vicinus Casey 1908:68. Arizona.

Eusattus reticulatus Say

- Zophosis reticulatus* Say 1823:250; *Eusattus reticulatus* LeConte 1851:132; *Discodemus reticulatus* LeConte 1862:223.
Discodemus brevipennis Casey 1908:61. Arizona.
Discodemus corrosus Casey 1908:61. El Paso, El Paso County, Texas.
Discodemus depressulus Casey 1908:62. Arizona.
Discodemus elongatulus Casey 1908:61. San Bernardino Ranch, Cochise County, Arizona, 3750 ft.
Discodemus knausi Casey 1908:62. Fremont County, Colorado.
Discodemus subsericeus Casey 1908:62. Arizona.

Eusattus robustus LeConte

- Eusattus robustus* LeConte 1866:112. San Clemente Island, Los Angeles County, California; *Nesostes robustus* Casey 1908:58.
Nesostes robustus postremus Casey 1908:59. San Clemente Island, Los Angeles County, California.

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RECENT LITERATURE

Advances in Ecological Research: Volume 9. Edited by A. Macfadyen. Academic Press, New York, San Francisco, London. 1975. 386 pp. \$30.50.

Contents include: Predation and population stability; Mathematical model building with an application to determine the distribution of Dursban insecticide added to a simulated ecosystem; The pressure chamber as an instrument for ecological research; The ecology of serpentine soils. — TDE.

Marine Insects. Edited by L. Cheng. American Elsevier Publishing Company, Inc., 52 Vanderbilt Ave., New York, N.Y. 10017. 1976. about 585 pp. \$62.50.

The chapters are divided into two sections, the first treating primarily ecological aspects, the second dealing with major groups of insects in marine environments. — TDE.

The Insect Integument. Edited by H. R. Hepburn. American Elsevier Publishing Company, Inc., 52 Vanderbilt Ave., New York, N.Y. 10017. 1976. about 580 pp. \$63.50.

Evolution of Gall-Forming Insects-Gall-Midges. B. M. Mamaev. Translated from Russian by A. Crozy and edited by K. M. Harris. Available from Translation Section, British Library Lending Division, Boston Spa, Wetherby, West Yorkshire, United Kingdom, LS23 7BQ. 317 pp. \$8.50.

This is a translation of the Russian book "Evolutsiya galloobrazuyushchikh nasekomykh-gallits", Leningrad, 1968, 237 pp. A price list of other translations in Entomology can be obtained from the Translation Section at the above address.

New Species of Bees in the Genera *Euplusia* and *Eufriesia*

(Hymenoptera: Apidae, Euglossini)

Lynn S. Kimsey

Department of Entomology, University of California, Davis, 95616

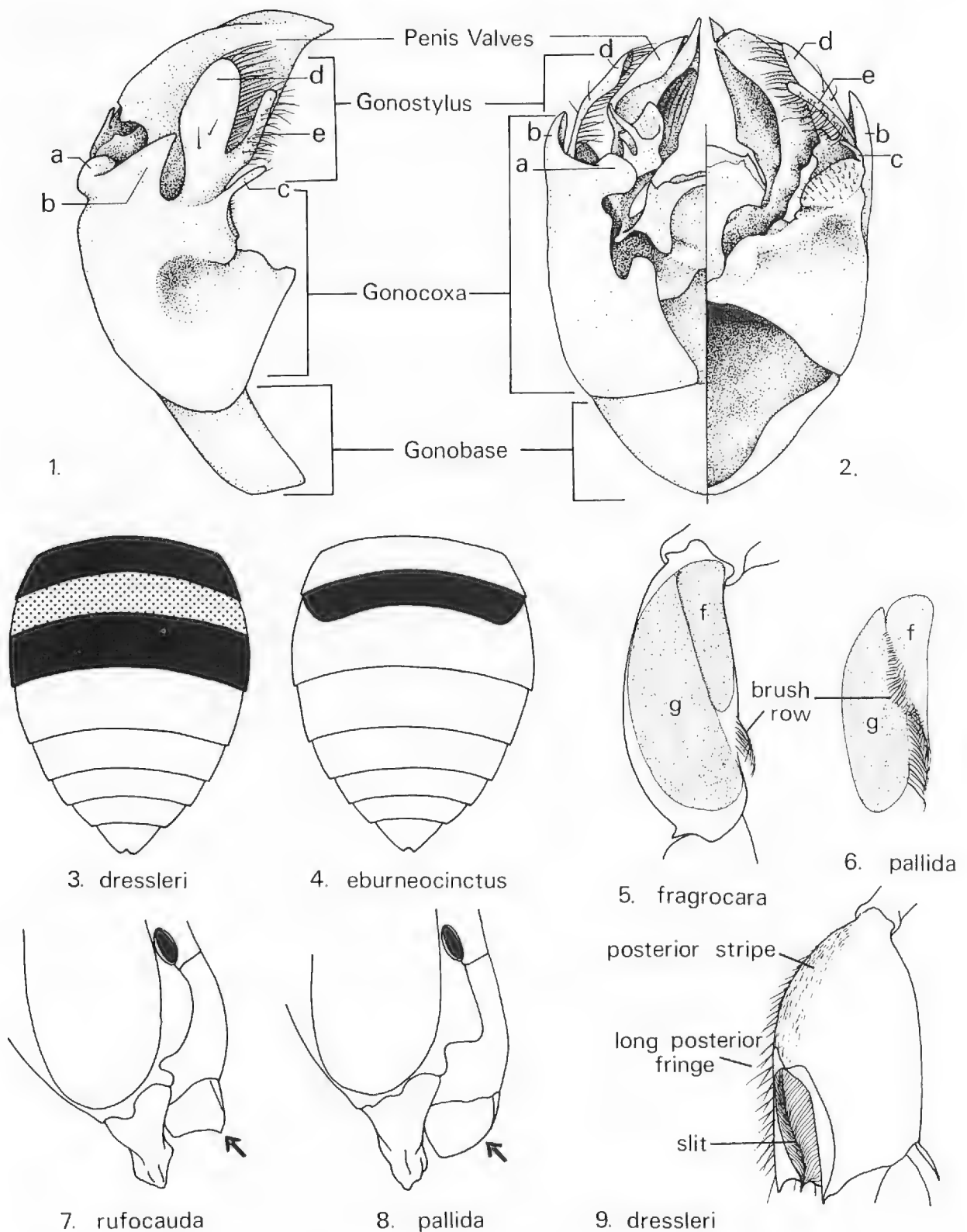
In the tribe Euglossini the non-parasitic genera *Euplusia* and *Eufriesia* are the most poorly represented in museum collections. With the advent of chemical "trapping" the numbers have increased and numerous new species previously uncollected have been found. Because of the numbers of new species being discovered in well traveled areas it is quite likely that there are many more than are described in this paper. As more collecting is done in parts of South America and Central America, especially between Costa Rica and Mexico, the ranges of many known species will undoubtedly be extended and more new species located. The present paper is part of a general revision of the genus *Euplusia* which is now in preparation.

To avoid confusion, simplified names have been used for specialized structures on the mid and hindlegs and male genitalia. Instead of attempting to describe these and make them more confusing than necessary they are illustrated in figures 1-9. Tongue length is considered to be the distance from the fold at the base of the mandibles to the labial palpi. All integumental colors in the descriptions with the exceptions of black and brown should be understood to be metallic in nature. In the following descriptions the thorax is assumed to include the propodeum and the abdomen is the apparent abdomen. Holotypes will be deposited in the institutions listed in the descriptions, the paratypes will be distributed among the following institutions as far as possible: University of California at Davis (UCD), American Museum of Natural History (AMNH), University of Kansas (KU), U.S. National Museum (USNM), and R. Dressler Collection, Smithsonian Tropical Research Institute (STRI). I would like to thank Dr. R.M. Bohart for reading this paper and giving comments and criticism.

***Euplusia anisochlora*, new species**

(Figs. 10, 22, 34)

Male: body length 15mm; tongue length 4mm, reaching midcoxa; head green; thorax green with scutellum blue-green; legs green to blue-green; hindtibia covered with short scattered appressed silvery pubescence, long posterior fringe black; tergum I blue-green; II-III purplish green with short black setae; IV-VII orange to coppery with long yellowish orange setae; clypeus with medial ridge broken, indistinct, punctures large and shallow; frons with large deep punctures to medium or small ones, striatiform in ocellar area; labrum with short median welt and two sublateral pointed ridges, appearing pointed in lateral view; mesopleuron laterally with medium punctures; midtibia with brush row as wide as tall, anterior felty patch half as long as posterior one; hindtibia with no process



Figs. 1-2. Male genital capsule, gonocoxal lobes (a-c), dorsal (a), lateral (b), ventral (c); gonostylar lobes (d-e), dorsal (d), ventral (e). 1, lateral view. 2, dorsal view left side, ventral view right side. Figs. 3-4. Tergal markings. Figs. 5-6. Male midtibial felty patches, anterior patch (f), posterior patch (g). Figs. 7-8. Male labrum lateral view. Fig. 9. Male hindtibia.

above spurs; sternum VIII lobes three times as long as wide and far apart (fig. 10); IX apically produced into two dorsal points in lateral view (fig. 22); gonostylus in lateral view with ventral lobe shorter than dorsal lobe; gonocoxal dorsal lobe a third as long as gonostylus (fig. 34).

Holotype Male, Cerro Jefe, Panama Prov., Panama, VI-24-1974 (R.L. Dressler, UCD). Paratypes, 4 ♂♂, Cerro Campana, Panama Prov., Panama, June-July; 2 ♂♂, Cerro Jefe, Panama Prov., Panama, May-June.

This species has only been found in central Panama. Except *caerulescens* there are no other *Euplusia* in Central America in which the male is predominantly green. It is distinguishable by having terga IV-VII bronzy to coppery, no special structure above the hindtibial spurs and the clypeus without a carina. It is labelled in some collections and publications as RD-935. Females are unknown.

***Euplusia boharti*, new species**
(Figs. 11, 23, 35)

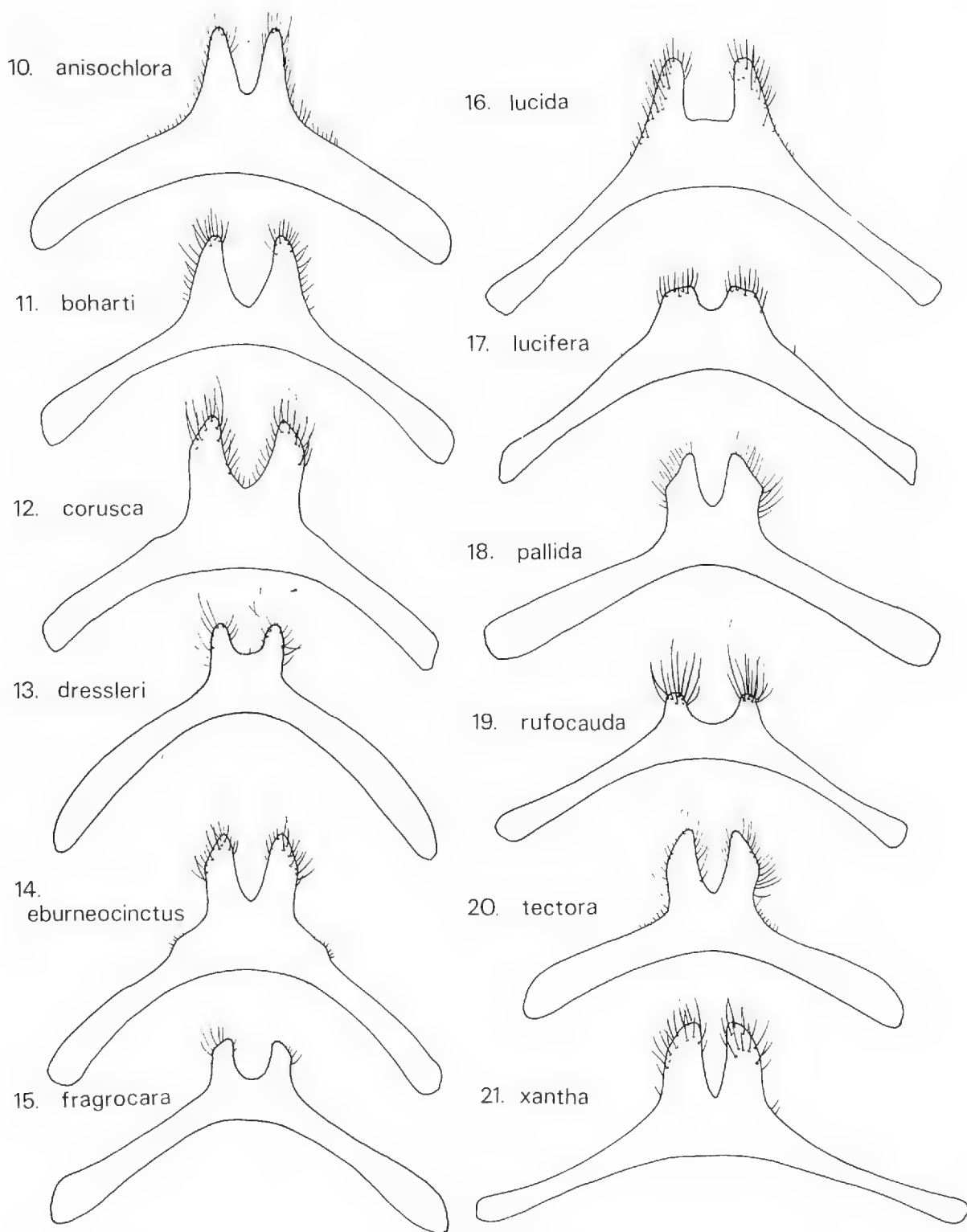
Male: body length 15mm; tongue length 5mm, reaching midcoxa; face yellowish green with clypeal ridge coppery; labrum dark blue-green; vertex and rest of head violet; scutal patches and anterior half of tegula blue-green; rest of thorax and tegula purple; legs purple to black except foretibia bluish; hindtibia with sparse band of short appressed gold pubescence on anterior margin, long posterior fringe black; terga I and II purplish black with black setae; III-VII greenish black with pale yellow setae; clypeus with one medial ridge, punctures large and shallow; frons with scattered large and small punctures; labrum with two sublateral pointed ridges and medial ridge equal in length, meeting medially; vertex with shallow medium and small punctures, polished and impunctate around ocelli and antennal sockets; mesopleuron laterally with medium punctures; midtibial brush row as wide as tall, separate from anterior felty patch, anterior patch a third as long as posterior one; sternum VIII lobes twice as long as wide and as far apart as tall (fig. 11); sternum IX apically with one dorsal point, ventral angle rounded in lateral view (fig. 23); gonostylar ventral lobe longer than dorsal; gonocoxal dorsal lobe a third as long as gonostylus (fig. 35).

Holotype Male, Rancho Grande, Aragua, Venezuela, IX-20-1973 (R.M. Bohart, UCD).

This species is similar to *andina* and *magretti*, but distinguishable by the bright yellowish green face, terga II-VII dark green and sternum VIII with lobes twice as long as broad and two-thirds as far apart as long. No female is known.

***Euplusia corusca*, new species**
(Figs. 12, 24, 36)

Male: body length 17mm; tongue length 7mm, reaching midcoxa; face green; rest of head black; scutal patches and tegula green; scutum and scutellum black with green margins; rest of thorax dark green to black; hind tibia with green stripe on posterior margin above slit, sparsely covered with short appressed yellow pubescence, long posterior fringe black; terga I-VII yellowish green; clypeus with medial welt impunctate and sublateral welts indistinct and punctate, punctures large, striatiform, becoming sparse toward antennal depressions; frons with large and small, deep punctures; vertex with small punctures, polished around ocelli; labrum with two sublateral ridges and a shorter medial ridge, appearing pointed in lateral view; mesopleuron laterally with medium and small punctures; midtibial brush row wider than tall, discontinuous with anterior felty patch, anterior patch more than half as long and half as wide as posterior one; sternum VIII lobes produced on elevated region, twice as long as broad (fig. 12); sternum IX apically produced into one elongate point in lateral view (fig. 24); gonostylar dorsal lobe equal in length to ventral lobe; gonocoxal dorsal lobe half as long as gonostylus (fig. 36).



Figs. 10-21. Sternum VIII. 10-16, 18-21, *Euplusia*; 17, *Eufriesia*.

Female: body length 18mm; tongue length as in male; face steel blue; rest of head, thorax and legs bluish black or black; tergum I dark green with short black setae; II-VI yellowish green, bronzy or orange depending on angle of light with yellow setae; clypeus with strong medial ridge, punctures large, dense and striatiform; labrum with short medial carina; antennal socket ringed by polished impunctate area; frons with scattered, deep, large and small punctures; vertex with small to medium punctures and dense micro-punctures around hindocelli.

Holotype Male, Barro Colorado I., Canal Zone, Panama, VI-13-1968 (R.L. Dressler, UCD). Paratypes, 4 ♂♂, same as Holotype, attracted to methyl cinnamate; 1 ♂, Pina area, Canal Zone, Panama, V-14-1959.

There is some similarity to *superba* in coloration, but this species has only one medial ridge and the long posterior fringe of the hindtibia in the male is pale, not black as in *superba*. The female characteristically has tergum I green and II-VI green to coppery. This species is tagged in some collections as RD-960. It is found in southern Costa Rica and Panama.

Euplusia dressleri, new species
(Figs. 3, 13, 25, 37)

Male: body length 18mm; tongue length 7mm, reaching midcoxa; face green to yellowish green; labrum black with some green laterally; rest of head black; scutal patches and tegula green; rest of thorax dark green to black; legs with some green on tibia, hindtibia with short appressed pubescence on green integumental stripe on posterior margin above slit, long posterior fringe yellow; forewing with medial cell darkened; tergum I black with some green highlights, covered with black setae; II anterior half green with yellow setae, posterior half black with black setae; III-VII bronzy with yellow setae (fig. 3); clypeus with medial ridge indistinct, punctate, punctures large, shallow, striatiform; antennal depressions with small to medium punctures; vertex with small punctures and micropunctures around ocelli; mesopleuron laterally with medium and small punctures; midtibial brush row wider than tall, anterior felty patch half as long and wide as posterior one; sternum VIII lobes 1.5 times as long as broad and far apart (fig. 13); sternum IX produced into two apical points in lateral view (fig. 25).

Holotype Male, Piña area, Canal Zone, Panama, V-18-1968 (R.L. Dressler, UCD). Paratypes, 7 ♂♂, same data as Type.

This species is only found in central Panama. Although similar to *elegans* in coloration the tongue is much shorter, reaching only the midcoxa and not sternum II, and the hindtibia is not completely clothed in yellow pubescence in the male as in *elegans*. Another characteristic is the lack of clypeal ridging. This species has been previously designated in some collections as RD-930.

Euplusia eburneocincta, new species
(Figs. 4, 14, 26, 38)

Male: body length 19mm; tongue length 6mm, reaching hindcoxa; face dark green; rest of head black; scutal patches dark green; rest of thorax black; legs black; hindtibial posterior margin above slit clothed in short appressed gold pubescence, long posterior fringe black; forewing with medial cell darkened; tergum I brown with dense whitish yellow setae; II with narrow anterior band of yellowish orange setae, wide medial brown band with black setae, posterior half coppery with yellowish orange setae; III anterior third purplish green with black setae, posterior part with yellowish orange setae; III-VII purplish green with yellowish orange setae (fig. 4); clypeus with impunctate medial welt between two parenthesis shaped punctate welts; labrum with two strong sublateral carinae and shorter medial welt, appearing pointed and slightly hooked in lateral view; clypeus with large shallow punctures; frons with large and small punctures; vertex with dense micropunctuation and scattered small punctures; midtibial brush row wider than tall, anterior felty patch half as long and wide as posterior one; mesopleuron laterally with

medium and small punctures; sternum VIII lobes twice as long as wide and far apart (fig. 14); IX produced apically into two points in lateral view (fig. 26); gonostylar dorsal lobe longer than ventral; gonocoxal dorsal lobe less than half as long as gonostylus (fig. 38).

Female: body length 21mm; tongue length 9mm, reaching sternum I; head, thorax and legs dark brown; tergum I brown with dense yellowish white setae; II anterior half black with short black setae, posterior half coppery with dense yellowish orange setae; III-V coppery with dense yellowish orange setae; VI bluish with dense yellowish orange setae; clypeus with one medial polished ridge; face with medium punctures becoming smaller towards frons and in antennal depressions; frons and vertex with dense small and scattered medium punctures.

Holotype Male, Dawa, Guyana, VIII-4-1969 (R. Hamer, USNM). Paratypes, 1 ♂, Santa Maria Erebató, Dto. Cedeño, Edo. Bolívar, Venezuela, attracted to vanillin, VIII-10-1975; 4 ♀♀, "Katabo" (Kartabo?), Bartica Dist., British Guyana, VII-9-1919.

No other species of *Euplusia* has tergum I clothed in dense yellowish white setae and tergum II with the anterior third to half black. It is found in Guyana and Venezuela.

***Euplusia fragrocara*, new species** (Figs. 5, 15, 27, 39)

Male: body length 16mm; tongue length 9mm, reaching hindcoxa; head green with facial hair white; thorax green with scutal patches lighter; legs green except hindtibia lower half purple, with scattered short appressed yellow pubescence on anterior margin, long posterior fringe black; terga I-VII green, I-III with dark brown setae dorsally and long yellowish orange setae laterally, IV-VII with yellowish orange setae; clypeus with strong impunctate medial ridge and two sublateral punctate welts, punctures large; antennal depression with small to medium punctures, polished around sockets; frons and vertex with scattered medium and small punctures; labrum with two sublateral carinae and shorter medial welt, appearing broadly pointed in lateral view; mesopleuron laterally with medium and small punctures; midtibial brush row separate from anterior felty patch and taller than wide, anterior patch half as long and as wide and as far apart as tall (fig. 5); sternum VIII lobes twice as long as wide and as far apart as tall (fig. 15); IX apically with one dorsal point and ventral angle rounded in lateral view (fig. 27); gonostylar ventral lobe twice as long as dorsal lobe; gonocoxal dorsal lobe half as long as gonostylus (fig. 39).

Holotype Male, Rio Pachitea, Huanuco Prov., Peru, II-6-1975, attracted to vanillin (R.L. Dressler, UCD). Paratypes, 5 ♂♂, same data as Type.

The male of this species appears much like *violacea* in coloration. It is generally larger and has a strong medial clypeal ridge which is lacking in *violacea*. Also the midtibial brush row is separate from the anterior felty patch whereas it is continuous in *Violacea*. The female is unknown. It is found in Peru and Ecuador.

***Euplusia lucida*, new species** (Figs. 16, 28, 40)

Male: body length 14mm; tongue length 19mm, exceeding tip of abdomen; clypeus coppery; frons and antennal area green; vertex and rest of head bluish purple; scutal patches and tegula green; rest of thorax bluish purple; legs purple with some green margins, hindtibia with scattered gold appressed pubescence, long posterior fringe yellowish brown; terga I-VII green to coppery depending on angle of light, terminal segments more strongly coppery, tergum I with some black setae on anterior margins, rest of tergum and



22. anisochlora



23. boharti



24. corusca



25. dressleri



26. eburneocinctus



27. fragrocara



28. lucida



29. lucifera



30. pallida



31. rufocauda



32. tectora



33. xantha

Figs. 22-33. Sternum IX. 22-28, 30-33, *Euplusia*; 29 *Eufriesia*.

II-VII covered with long golden setae; clypeus with medial impunctate welt, punctures medium and shallow; antennal depression with large impunctate area on ocular side of socket, punctures medium and shallow; frons with dense medium and small, deep punctures; vertex with medium and small punctures; labrum with two sublateral welts appearing broadly pointed in lateral view; mesopleuron laterally with medium punctures; midtibial brush row wider than tall, anterior felty patch half as long and wide as posterior one; sternum VIII lobes twice as long as broad and as long as far apart (fig. 16); IX with one dorsal point, ventral angle rounded in lateral view (fig. 28); gonostylar dorsal lobe shorter than ventral one; gonocoxal dorsal lobe two-thirds as long as gonostylus (fig. 40).

Holotype Male, Valle Anchicaya, Colombia, I-23-1971, attracted to vanillin (H. Kennedy, UCD). One other specimen has been seen: a ♂ from Napo, El Neme Alluro, Ecuador, VI-28-1969, attracted to cineole.

This species is similar to *macroglossa* superficially, having an equally long tongue. The face is coppery, green and blue not steel blue as in *macroglossa*. The genitalia is also characteristic with the dorsal lobe of the gonostylus shorter than the ventral lobe and the ventral angle of sternum IX rounded. Only two specimens have been seen, one from Colombia and one from Ecuador. The female is unknown.

Euplusia pallida, new species (Figs. 6, 8, 18, 30, 42)

Male: body length 16mm; tongue length 16mm, reaching tip of abdomen; face green with coppery highlights; rest of head dark violet, covered sparsely with erect yellow setae; scutal patches and anterior half of tegula yellowish green with dense whitish setae; rest of thorax dark green to blue-green; fore and midtibia blue-green; hindtibia black with integumental blue-green stripe along posterior margin with short appressed coppery pubescence, long posterior fringe yellow; rest of legs black; tergum I coppery with brown setae; II-III coppery with yellowish orange setae; IV-VII yellowish green with pale yellow setae; clypeus centrally depressed with medial welt, punctures large; frons and antennal depressions with small to medium punctures, narrowly polished around sockets; vertex with micropunctuation and scattered small punctures; labrum with three ridges, broadly pointed in lateral view (fig. 8); mesopleuron laterally with medium punctures; midtibial brush row wider than tall, anterior felty patch half as long and wide as posterior one (fig. 6); hindtibia with strong knob above spurs; sternum VIII lobes three times as tall as wide and far apart (fig. 18); IX with two apical points in lateral view (fig. 30); gonostylar ventral lobe longer than dorsal lobe; gonocoxal dorsal lobe less than half as long as gonostylus (fig. 42).

Holotype Male, Tuxtla Gutierrez, Chiapas, Mexico, VII-1968, attracted to d-carvone (C.H. Dodson, UCD). Paratypes, 3 ♂♂, same data as Type.

This species is very similar to *surinamensis* and *mexicana*. It differs in the following ways: the tongue is longer, reaching the tip of the abdomen; tergum I is coppery rather than dark brown or black; and the scutal patches are covered with dense off-white setae rather than yellow or brown. No female is known. It is found in southern Mexico.

Euplusia rufocauda, new species (Figs. 7, 19, 31, 43)

Male: body length 14mm; tongue length 7mm, reaching hindcoxa; face below antennal sockets coppery; frons yellowish green; vertex and rest of head purple; scutal patches

and anterior half of tegula green; rest of scutum purple; scutellum black; rest of thorax purple; legs black with some metallic highlights except hindtibia dark purple with scattered short appressed yellow pubescence becoming denser on upper half, long posterior fringe black; tergum I reddish purple with black setae; II reddish purple with black setae, posterior corners orange with yellow setae; III-VII orange or green depending on angle of light, with long yellow setae; clypeus with three low punctate welts; face with large shallow punctures becoming small and less distinct on vertex, polished around ocelli; labrum produced into two tooth-like processes, appearing sharply pointed in lateral view (fig. 7); mesopleuron laterally with medium and small punctures; midtibia with large brush row, wider than tall, anterior felty patch half as long and wide as posterior one; sternum VIII lobes as wide as tall and twice as far apart as tall (fig. 19); sternum IX produced into two apical points in lateral view (fig. 31); gonostylar ventral lobe shorter than dorsal; gonocoxal dorsal lobe a third as long as gonostylus (fig. 43).

Female: body length as in male; tongue length shorter, only reaching midcoxa; head, thorax and legs purple; terga I and II violet with black setae, posterior corners of II scarlet with yellowish orange setae; II-VI scarlet with green posterior margins and yellowish orange setae; clypeus with medial welt; face with large punctures becoming small on vertex, polished and impunctate around ocelli.

Holotype Male, Cerro Campana, Panama Prov., Panama, VII-11-1976 (L.S. Kimsey, UCD). Paratypes, 14 ♂♂, same data as Type, April-July; 4 ♂, 4 ♀, Cerro Jefe, Panama Prov., Panama, April-July and December; 1 ♂, 4 ♀, Cerro Azul, Panama Prov., Panama, July.

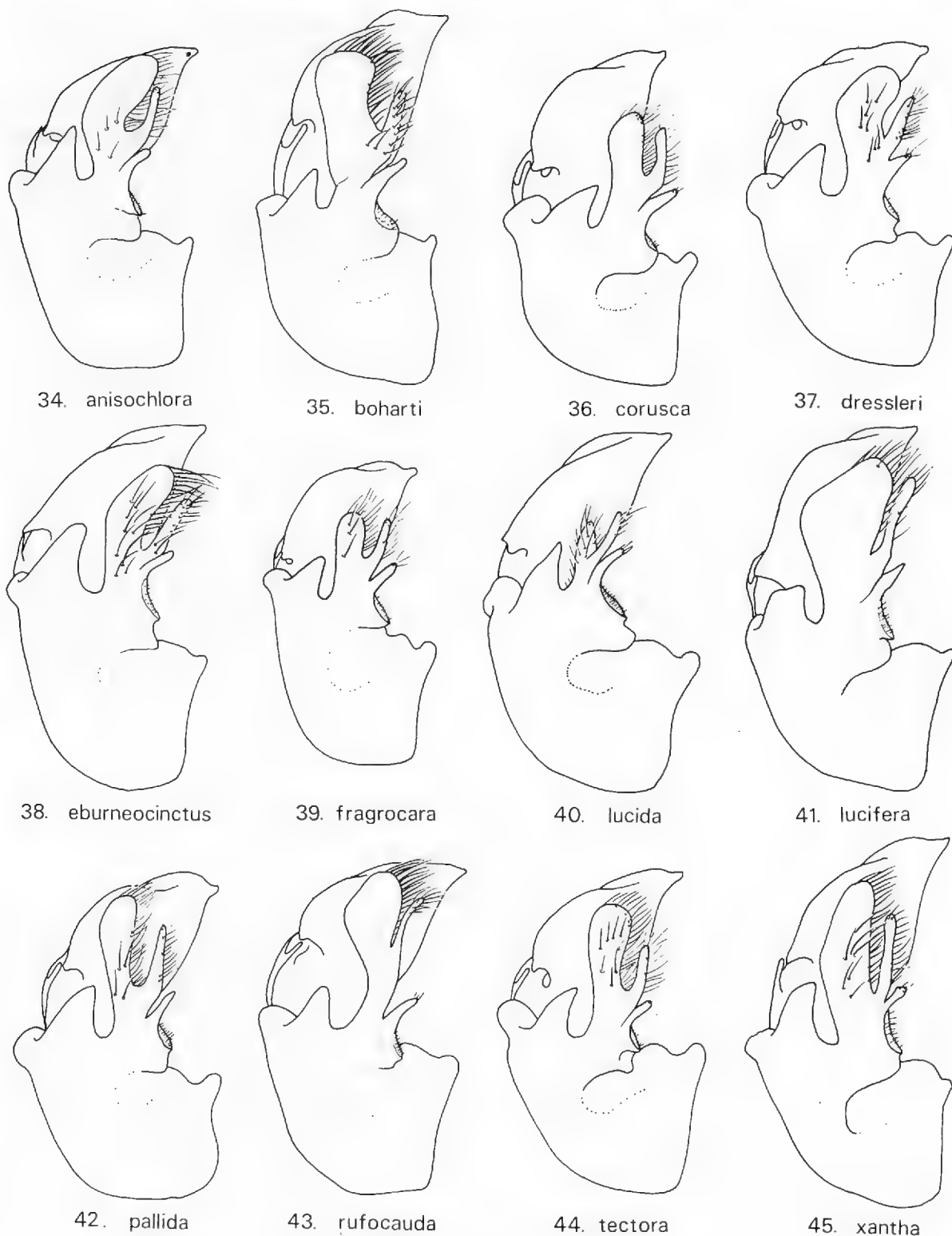
Though very similar to *chrysopyga* it is brighter in color and distinguishable by the red posterior corners of tergum II in both sexes. The female has a shorter tongue than *chrysopyga*. The male has three vertical welts on the clypeus, *chrysopyga* has only one. This species is tagged RD-296 in some collections. It is found in Peru and Panama.

Euplusia tectora, new species (Figs. 20, 32, 44)

Male: body length 17mm; tongue length 17mm, reaching tip of abdomen; clypeus centrally coppery; rest of face green; rest of head black; scutal patches and tegula dark blue-green; rest of thorax black; legs black with some metallic highlights; hindtibia covered with sparse appressed coppery pubescence, long posterior fringe yellow; tergum I black with black setae; II-VII coppery with yellow setae; clypeus with horseshoe shaped welt with partially inserted medial ridge; face with large striatiform punctures becoming small along ocular margin and in antennal depressions, polished and impunctate around sockets; interantennal space with broad impunctate polished stripe; frons with small and scattered large punctures; vertex with micropunctuation and scattered large punctures; labrum with three vertical welts, broadly rounded in lateral view; mesopleuron laterally with small and medium punctures; midtibial brush row wider than tall, anterior felty patch more than half as long and half as wide as posterior one; hindtibia with one pointed process above spurs; sternum VIII lobes three times as long as wide and half as tall as far apart (fig. 20); IX with two apical points in lateral view (fig. 32); gonostylar ventral lobe longer than dorsal lobe; gonocoxal dorsal lobe a third as long as gonostylus (fig. 44).

Holotype Male, Frijoles, Canal Zone, Panama, VI-28-1968 (R.L. Dressler, UCD). Paratypes, 6 ♂♂, same data as Type.

This is another species very similar to both *surinamensis* and *mexicana*. The tongue is longer in *tectora* than in either of the other species and the hindtibia lacks the stripe of short appressed gold pubescence on the posterior margin found in the others. The females are practically impossible to differentiate among these three species except by geographic distribution. This species is tagged RD-88 in some collections. It is found only in central Panama.



Figs. 34-45. Male genital capsule lateral view. 34-40, 42-45, *Euplusia*; 41, *Eufriesia*.

***Euplusia xantha*, new species**
(Figs. 21, 33, 45)

Male: body length 20 mm; tongue length 6mm, reaching midcoxa; rest of head black; scutal patches green; rest of thorax black; hindtibia with band of short appressed gold pubescence on posterior margin above slit, long posterior fringe black; forewings with medial cell darkened; tergum I dark brown with dense pale yellow setae; II-VII green with dense yellow setae; clypeus with one medial ridge and two parenthesis shaped sublateral ridges, punctures shallow, medium sized, denser in antennal sockets; frons with scattered medium and small deep punctures; vertex with small and micropunctures; labrum

with two sublateral carinae and shorter medial ridge, pointed in lateral view; mesopleuron laterally with medium and small punctures; midtibial brush row wider than tall, not separate from anterior felty patch, anterior patch half as long and wide as posterior one; tergum VII not posteriorly cleft; sternum VIII lobes twice as long as wide and far apart (fig. 21); sternum IX produced into two apical points in lateral view (fig. 33); gonostylus ventral lobe shorter than dorsal lobe; gonocoxal dorsal lobe half as long as gonostylus (fig. 45).

Female: body length 20mm; tongue length 9mm, reaching hindcoxa; head, thorax and legs dark brown; tergum I-VI as in male; clypeus with one medial carina, depressed around tentorial pits, with medium punctures; antennal depressions with dense shallow medium punctures, polished and impunctate around socket; frons and vertex with dense small and micropunctures; labrum with three ridges.

Holotype Male, Rockstone, Mazaruni Potaro, Guyana, attracted to methyl salicylate, VIII-10-1970 (N.H. Williams, USNM). Paratypes, 2 ♀♀, Kartabo, Bartica Dist., British Guiana, VII-9-1919.

The pale yellow setae on tergum I but no black banding on tergum II is characteristic for this species. It is similar to *fallax* but differs in the following characters: the male has only a narrow band of yellow pubescence on the hindtibia rather than fully clothed as in *fallax*, the gonostylar ventral lobe is shorter than the dorsal lobe and the labral carinae are thin and bladeliike; the female has a broad face depressed around the tentorial pits, the clypeus has a low impunctate medial welt and the terga are densely clothed in yellow setae with the setae on tergum I frequently paler.

***Eufriesia lucifera*, new species**

(Figs. 17, 29, 41)

Male: body length 16mm; tongue length 6mm, reaching midcoxa; face green; rest of head, thorax, legs and terga I and II black with black setae; hindtibia long posterior fringe black; terga III-VII coppery or yellowish green depending on angle of light, with yellowish orange setae; clypeus with two sublateral carinae and low medial welt; face, frons and vertex with small scattered punctures, polished and impunctate around ocelli; labrum with two sublateral carinae and low medial welt, appearing flat in lateral view; mesopleuron laterally with small and medium punctures; midtibia lacking brush row, anterior felty patch half as long and wide as posterior one; sternum VIII lobes as wide as long and far apart (fig. 17); IX produced into two apical points and apically expanded in lateral view (fig. 29); gonostylar ventral lobe as long as dorsal lobe; gonocoxal dorsal lobe a fourth as long as gonostylus (fig. 41).

Female: body length 19mm; tongue length 7mm, reaching midcoxa; coloration as in male; clypeus with medial stripe polished and impunctate; face with deep medium punctures becoming denser at vertex between ocelli; labrum with strong medial ridge slightly depressed on either side of ridge.

Holotype Male, 19km north El Llano, El Llano-Cartí Rd., Panama Prov., Panama, IV-3-1975 (M.L. Siri, UCD). Paratypes, 2 ♂♂, same data as Type.

This species is readily distinguishable from *Eufriesia pulchra* by the dark head and median clypeal welt in the male. The only other species in this genus, *pulchra*, has a bright yellow or green metallic head with yellow facial hair. The facial hair in *lucifera* is black. The male genitalia is also characteristic with the apex of sternum VIII broadly expanded in *lucifera* and simple in *pulchra*. This species is tagged as RD-237 in some collections. It is found in Panama, Costa Rica, Colombia and Ecuador.

New Species of *Eleodes* (*Blapylis*) from Western United States

(Coleoptera: Tenebrionidae)

Ronald E. Somerby

Laboratory Services/Entomology, California Department of Food and Agriculture,
Sacramento 95814

The subgenus *Blapylis* last received comprehensive treatment by Blaisdell in 1909. Subsequently, Boddy (1957) described two additional species. Five new species of this complex group of beetles are here described in order to make the names available for more comprehensive revisionary work in preparation. Species groups and other infrageneric groupings will be defined then. A provisional key to species of *Blapylis* is given in Somerby (1972).

The species descriptions include three ratios: 1) elytral length divided by greatest width; length is measured from the last third of the scutellum to the tip of the elytral apex; 2) length of the foretibia divided by the length of the pronotum; length of the foretibia is measured from the most proximal point to the most distal point (not including the setae along the distal margin, see fig. 19a). Pronotal length is measured along the middorsal line; 3) the length of the setal pad (as measured along the venter of the probasitarsus) divided by the height of the basitarsus. Preabdominal width of the epipleura is measured at the point where the abdomen joins the thorax.

Eleodes wakelandi, new species (figs. 3, 20, 21)

Diagnosis. — *Eleodes wakelandi* is most similar to *E. novoverruculus* Boddy and *E. nunenmacheri* Blaisdell (elytral tubercles well developed to the midline excluding the punctae). *Eleodes wakelandi* is smaller than *novoverruculus* and differs in having the pronotum hirsute laterally to pilose medially with the propleura pilose, the pilose condition being absent in *novoverruculus*. *Eleodes wakelandi* is separable from *nunenmacheri* by having somewhat smaller tubercles along the medial area of the elytra with dorsum semi-hirsute (pilose in *nunenmacheri*). Females of *wakelandi* can be separated from the females of all other species of *Blapylis* by their broad ovipositor valves (figs. 20, 21).

Holotype female. — CAS Type No. 11,445, exemplar male, and 12 male, 12 female paratypes from Sucker Creek, Malheur County, Oregon, VII-30-1926; collected by C. Wakeland.

Holotype and seven paratypes, California Academy of Sciences, San Francisco; 18 paratypes, Brigham Young University, Provo, Utah, and University of Idaho, Moscow. Features of exemplar male which differ from holotype included in parentheses.

Head. — Eyes with lateral surface slightly convex posteriorly; genal process of moderate length; median lobe of mentum rounded and slightly reduced.

Prothorax. — Notum (fig. 3) 2.9 mm (2.8 mm) long, 4.0 mm (3.7 mm) wide; punctae large (moderate), deep, tubercles present next to margin, vestiture pilose to laterally hirsute. Anterior emargination slight, apical angles rounded; anterior width of pronotum narrower (slightly narrower) than posterior width; lateral margin arcuate (moderately arcuate), non-angulate, basal constriction moderately (slightly) developed; convexity (as seen in cross section) strong (moderate) with lateral fourth slightly deflexed. Pleura punctate, tuberculate, tubercles small to moderate, extending to basal area, vestiture pilose on shiny surface. Prosternum with process reduced.

Elytra. — Length 6.7 mm (6.1 mm), width 5.4 mm (4.7 mm); length to width robust 1.7 (1.3). Punctae absent, moderate sized tubercles present laterally to medially with two subequally distinct sizes except medially; vestiture nearly hirsute on a shiny surface without alutaceous network. Elytra moderately expanded (slightly expanded) basally; with moderately abrupt deflection (planate) from base to disc. Elytral apex sloping strongly, blunt. Epipleura 0.54 mm (0.51 mm) wide at base with clearly formed moderately deep punctae and fine tubercles, lacking alutaceous network; basal width moderately expanded (subequal) compared to preabdominal width; humeral area inflated (lateral aspect weakly angled), humeri slightly angled.

Venter. — Abdomen with moderately large, deep punctae; tubercles absent on second visible sternite, surface shiny. foreleg in anterior silhouette with distal, ventral surface of femur straight; tibia with proximal, ventral border not constricted, short, ratio 0.72 (moderate, 0.86), ventro, distal surface of basitarsus moderately produced (slightly produced).

Secondary sexual characteristics. — Male with golden tuft of setae on probasitarsus minute, ratio 0.2; fine golden setae present in plantar groove of second protarsal segment, absent from groove of first segment of mesotarsus. Female with coarse black setae on plantar surface of probasitarsus distributed as strongly projecting bundle. Parameres is in figure 15, 24; valvifer 2, figure 20, 21.

Comments. — The species was named in honor of Claude Wakeland who studied the biology and ecology of several economically important species of *Eleodes* from the Reburg Bench region of Idaho. His work was published in 1926 as a Research Bulletin.

The holotype has a 1932 Blaisdell determination label with the name *Eleodes nunenmacheri verrucula* Blaisdell. This name was applied to a number of species having some populations with similar elytral sculpture (see Boddy 1957:196), particularly the large round tubercles with smaller tubercles in the interstices. *Eleodes wakelandi* was also previously determined as *E. caseyi* Blaisdell, *E. pimelioides* Mannerheim, *E. brunripes* Casey, *E. cordatus* Eschscholtz, and *E. brevisetosus* Blaisdell. Boddy (in Hatch, 1965:156) misidentified specimens of *wakelandi* as *caseyi*. The two species are remarkably similar to each other. (See Somerby, 1972: Somerby and Doyen, 1975).

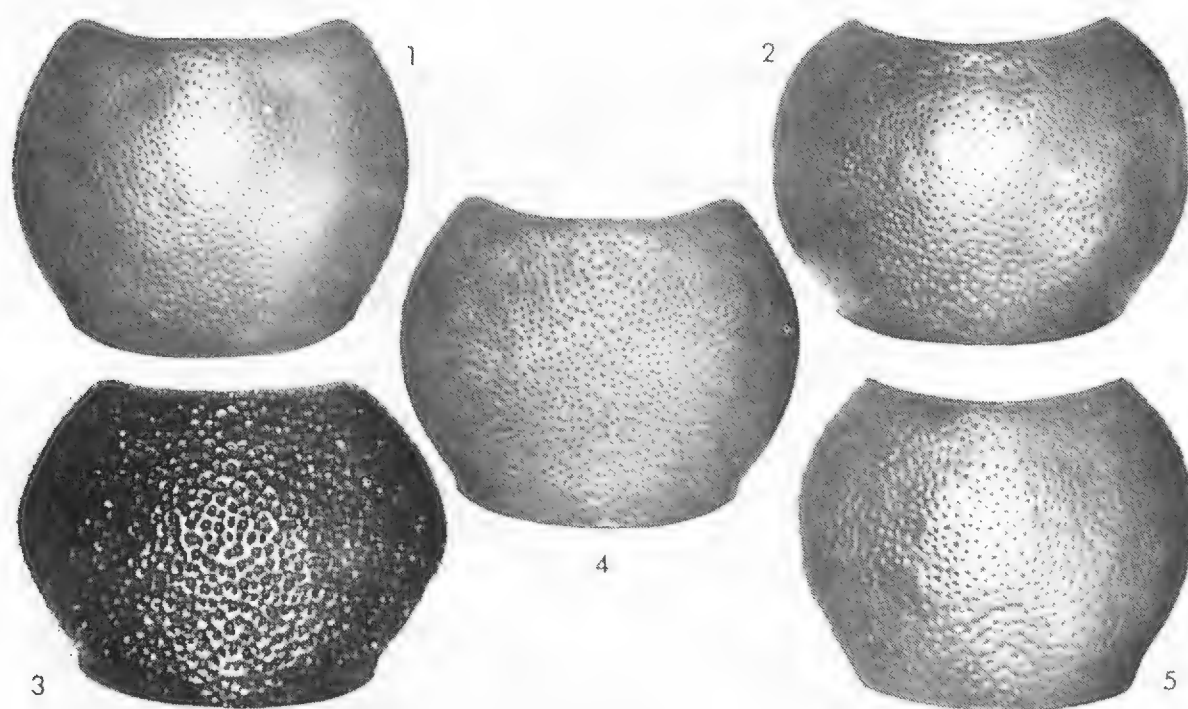
Ecology and distribution. — Desert scrub to arid coniferous woodland, 700 m to 1500 m, April to September from southern Idaho (many records) and southeastern Oregon, south and east to northern Utah. Barr (personal communication) records specimens from *Chrysothamnus* at Mountain Home, Idaho. One museum specimen was found with a tachinid (Diptera) pupa.

Specimens examined. — 49 males, 36 females. Idaho: Bonneville County, Idaho Falls; Canyon County, Caldwell, Parma; Carabou County, Soda Springs; Elmore County, Mountain Home; Fremont County, St. Anthony; Jefferson County, Terreton; Madison County, Rexburg; Minidoka County, Rupert, 4 mi. E.; Owyhee County, Big Area; Power County, American Falls; Twin Falls County, Twin Falls; Not placed in county; Fort Sherman. Oregon: Malheur County, Sucker Creek. Utah: Weber County, Ogden.

***Eleodes panamintensis*, new species** (Figs. 6, 11, 12, 16, 17)

Diagnosis. — This species is most similar to *E. tenebrosus* Horn from which it is separated by having the proximal, ventral border of the protibia moderately constricted (females, slightly constricted). The mesobasitarsus of the male lacks fine yellow setae in the distal plantar area, the pronotal disc lacks a basal constriction of the lateral margins which are weakly arcuate.

Holotype male. — CAS Type No. 11,435, and exemplar female, Thompson Camp, Panamint Mountains, 2030 m, Inyo County, California, VIII-19-1970, collected by L. La Pre X-2-1970. Seven male, 11 female paratypes, from type locality from III-29-1970 to VII-19-1971. One male paratype, Cowdung Canyon, Panamint Mountains, 2075 m, VII-3-1971, K. Mieras. The holotype and 6 paratypes are deposited in the California Academy of Sciences. Other paratypes in California Insect Survey, Kirby W. Brown collection, Los Angeles County Museum, Ohio State University, United States National Museum, and



Figs. 1-5 *Eleodes* (Blapyllis) sp.; pronotum, dorsal view: Fig. 1, *E. aristatus* new species holotype; Fig. 2, *E. orophilus* new species, holotype; Fig. 3, *E. wakelandi* new species, holotype; Fig. 4, *E. volcanensis* new species, holotype; Fig. 5 possibly *E. tenebrosus* from Spider Cave (Snake Creek Region), White Pine Co., Nevada.

Ronald E. Somerby collection. Features of exemplar female which differ from holotype included in parentheses.

Head. — Eyes with lateral surface slightly convex posteriorly; genal process of moderate length; median lobe of mentum rounded, lateral lobes of mentum exposed.

Prothorax. — Notum (fig. 6, surface as in 5) 4.3 mm (4.4 mm) long, 5.2 mm, (5.8 mm) wide; punctae small, shallow, tubercles present next to margin; vestiture inconspicuous, not noticeably hispid laterally, surface matte. Anterior emargination moderate, apical angles obtuse, anterior width of pronotum slightly smaller than posterior width (anterior width subequal to posterior width); lateral margin slightly arcuate, non-angulate, basal constriction absent; convexity (as seen in cross section) strong (moderate) with lateral fourth slightly deflexed. Pleura with punctae not evident, tubercles small with large tubercle free areas (reduced tubercle free area); vestiture hispid on submatte surface. Prosternal process moderately developed.

Elytra. — Length 11.4 mm (12.2 mm), width 6.4 mm (7.5 mm) length to width long, 1.8 (1.6). Moderately large, deep punctae present medially to laterally, coalescing in dorso-lateral area; punctae and tubercles in incipient rows. Tubercles small but variable with most larger tubercles of same diameter, with little size reduction laterally to medially; vestiture hispid, surface matte with some alutaceous lines. Elytra slightly expanded basally; planate from base to disc; elytral apex oval (subobtuse), gradually sloping. Epipleura 0.6 mm wide at base with faint shallow punctae, fine tubercles sparse to absent basally, lacking an alutaceous network; basal width subequal to preabdominal width, humeral area inflated, humeri rounded.

Venter. — Abdomen with moderately large, deep punctae; tubercles present on second visible sternite (scarcely present medially although noticeable laterally), surface submatte. Foreleg in anterior silhouette with distal, ventral surface of femur slightly sinuate; tibia with proximal, ventral border moderately constricted (slightly constricted), moderately long, ratio 1.0 (0.9), distal, ventral surface of basitarsus not produced.

Secondary sexual characteristics. — Male with setal pad on probasitarsus minute, ratio 0.2; lacking fine golden setae in plantar grooves of second protarsal segment and

first segment of mesotarsus. Female with coarse black setae on plantar surface of probasitarsus distributed as two loosely consolidated lateral rows. Parameres figure 11, 12; valvifer 2, figures 16, 17.

Comments. — The general overall size, appearance, and shape of the pronotum in *panamintensis* is quite similar to *E. (Melaneleodes) concinnus* Blaisdell with which it is sympatric. The two species are easily confused with one another in the field.

Ecology and distribution. — Examples were taken in Pinyon-juniper woodland under leaf litter and trash from 2000 m to 2100 m, from June through October.

Specimens examined. — 9 males, 11 females. California: Inyo County, Panamint Mountains, Cowdung Canyon, Thompson Camp (site of Panamint City).

***Eleodes aristatus*, new species** (Figs. 1, 9, 10, 13, 14)

Diagnosis. — This species is most similar to *E. tenebrosus* from which it differs by having distinct, moderately deep punctae on a submatte pronotal disc (Fig. 1). *Eleodes tenebrosus* from the White Mountains have shallow punctae on a matte pronotal disc (Fig. 5). Females of *aristatus* differ from *tenebrosus* by lacking coarse black setae that interrupt the probasitarsus.

Eleodes aristatus is also similar to *E. robinetti* Boddy from which it differs by having the apical and basal pronotal widths subequal with the pronotal punctae smaller and less dense. In *aristatus* the tibial length is less than the pronotal length (10 males, mean 0.96, range 0.92 to 1.0; 1 female, 0.88; in *robinetti* tibial length is relatively greater (10 males, mean 1.06, range 1.02 to 1.10, 1 female 0.94).

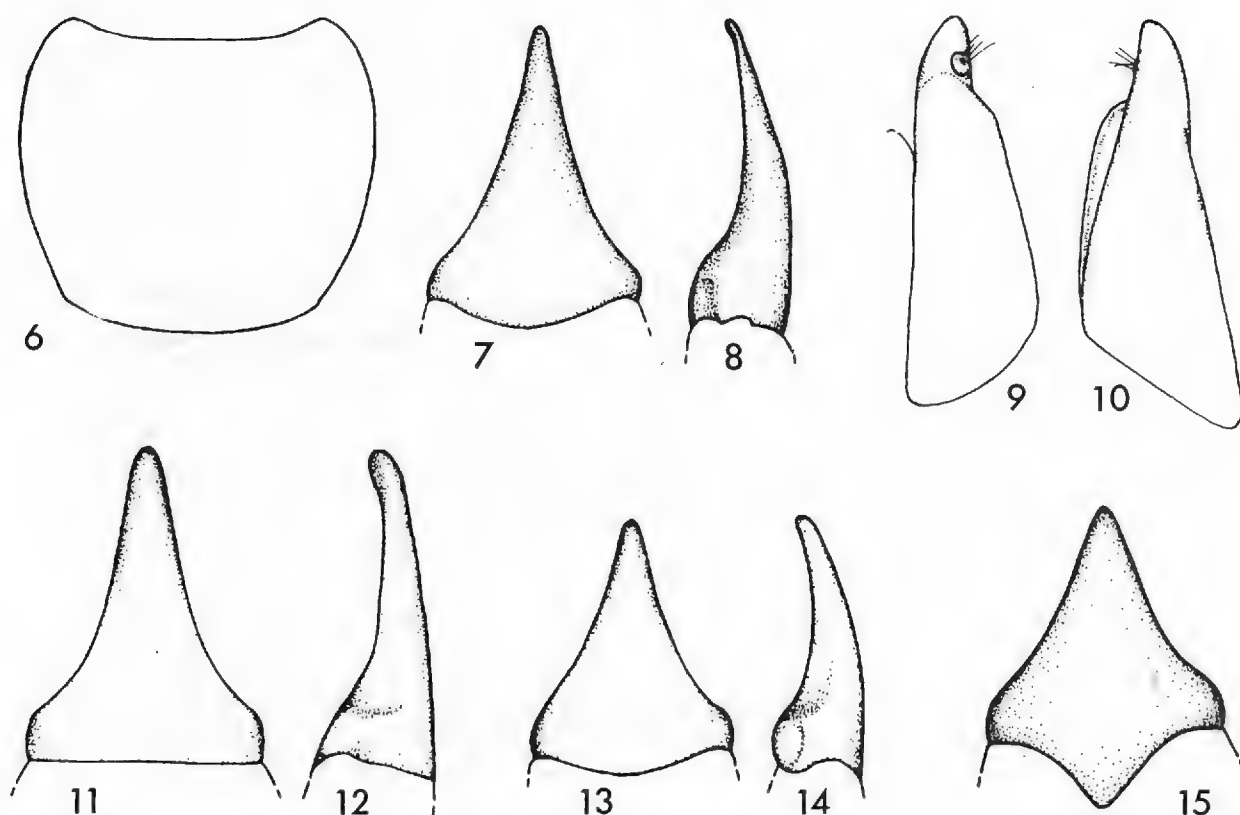
Holotype male. — CAS Type No. 11,436, and exemplar female, Crooked Creek Laboratory, White Mountains, 3085 m, Mono County, 3 airline miles, north Inyo County line, California, VII-II-1961, collected by H. V. Daly. Fourteen male, 8 female paratypes from type locality from VII-11-1961 to VIII-20-1963. The holotype and six paratypes will be deposited at the California Academy of Sciences. Other paratypes in the Essig Museum of Entomology. Paratypes will be sent to Kirby W. Brown, Los Angeles County Museum, Ohio State University and the United States National Museum. Features of exemplar female which differ from holotype are included in parentheses.

Head. — Eyes with lateral surface slightly convex posteriorly; genal process of moderate length; median lobe of mentum variably angular (rounded), lateral lobes of mentum exposed (weakly obscured).

Prothorax. — Notum (Fig. 1) 3.5 mm (3.4 mm) long, 4.3 mm (4.5 mm) wide; punctae small, moderately deep, tubercles present on lateral third, vestiture inconspicuous, not noticeably hispid laterally; surface submatte. Anterior emargination moderate, apical angles obtuse, anterior width of pronotum slightly smaller than posterior width (anterior width subequal to posterior width); lateral margin slightly arcuate, non-angulate, basal constriction slightly sinuous; convexity (as seen in cross section) moderate with lateral fourth evenly arcuate. Pleura with punctae not evident, tubercles small to moderate, and restricted to basal area; vestiture hispid on submatte surface. Prosternal process moderately developed.

Elytra. — Length 8.7 mm (8.4 mm), width 5.1 mm (5.7 mm) length to width long, 1.7 (moderate, 1.5). Moderate, shallow punctae present in medial area, punctae and tubercles evenly distributed. Tubercles small with most larger tubercles of subequal size, with little reduction laterally to medially; vestiture hispid, surface matte without obvious alutaceous network. Elytra slightly expanded basally; planate from base to disc. Elytral apex oval (subobtuse) gradually sloping. Epipleura 0.60 mm (0.66 mm) wide at base, without evident punctae, with fine tubercles sparse to absent basally, lacking in alutaceous network; basal width moderately expanded compared to preabdominal width, humeral area inflated, humeri rounded.

Venter. — Abdomen with moderate (small), shallow punctae; tubercles present on second visible sternite, surface shiny. Foreleg in anterior silhouette with distal, ventral surface of femur slightly sinuate; tibia with proximal, ventral border not constricted, of moderate length, ratio 0.92 (short 0.88); ventrodiscal surface of probasitarsus not produced.



Figs. 6-15 *Eleodes* (Blapyllis) sp.; pronotal outline and genitalia: Fig. 6, *E. panamintensis* new species, pronotal outline of holotype; Fig. 7, 8, *E. volcanensis* new species: dorsal view; lateral view of parameres, respectively of holotype; Fig. 9, 10, *E. aristatus* new species: dorsal view; ventral view of valvula, respectively of topotype; Fig. 11, 12, *E. panamintensis* new species: dorsal view; lateral view of parameres, respectively of holotype; Fig. 13, 14, *E. aristatus* new species: dorsal view; lateral view of parameres, respectively of holotype; Fig. 15, *E. pimelioides* from Fort Bridger, Uinta Co., Wyoming, dorsal view of parameres of holotype.

Secondary sexual characteristics. — Male with setal pad on probasitarsus short, ratio 0.41; fine setae present in plantar groove of second protarsal segment. Lacking fine golden setae in plantar groove of first segment of mesotarsus. Female with coarse black setae on plantar surface of probasitarsus distributed as two loosely consolidated lateral rows. Parameres figure, 13, 14; valvifer 2, figure 9, 10.

Comments. — The species is named after the bristlecone pine (*Pinus aristata* Engelman). Examples of *E. aristata* were previously determined as *tenebrosus*.

Ecology and distribution. — The species occurs in the bristlecone pine community in the White Mountains of Inyo and Mono counties along the California-Nevada border northeast of Bishop, California, from 3400 m to 3700 m, in sympatry with *E. tenebrosus*. The latter is more abundant at lower elevations (below 3500 m). Examples of *aristatus* were taken in June, July and August.

Specimens examined — 31 males, 33 females. California: Inyo County, Patriarch Tree, Reed Flat, Schulman Grove bristlecone pine area, White Mountains; Mono County, Big Bend Public Camp, Blanco's Corral, Cottonwood Creek, Crooked Creek Laboratory, Piute Mountain, Sheep Mountain.

***Eleodes volcanensis*, new species** (Figs. 4, 7, 8, 18)

Diagnosis. — This species is most similar to *E. robinetti* from which it differs in having a more pronounced basal pronotal constriction and by the elytral surface forming an obtuse angle with the epipleura, rather than being inflated as in *robinetti*. The forelegs

are relatively long and less robust (Fig. 18) than the forelegs of other related species, except *robinetti*. The prosternal process of *volcanensis* is reduced with the propleural tubercles small and with a tubercle-free area posterodorsal of the coxae. The elytral punctae are moderate, somewhat deep.

Holotype male. — CAS Type No. 11,437, Crater Lake National Park, Klamath County, Oregon, VII-14-34, collected by E. C. Van Dyke. Holotype male and one male paratype from type locality deposited in the California Academy of Sciences.

Head. — Eyes with lateral surface slightly convex posteriorly; genal process of moderate length; median lobe of mentum rounded, lateral lobes of mentum exposed.

Prothorax. — Notum (Fig. 4) 3.3 mm long, 4.1 mm wide, punctae moderately large, deep, tubercles present on lateral third, vestiture inconspicuous and not noticeably hispid laterally, surface submatte. Anterior emargination moderate, apical angles obtuse; anterior width of pronotum slightly smaller than posterior width; lateral margin arcuate, non-angulate, base moderately constricted; convexity (as seen in cross section) moderate with lateral fourth evenly arcuate. Pleura with punctae not evident, tubercles small, large tubercle-free area near base, vestiture hispid on shiny surface; prosternal process reduced.

Elytra. — Length 8.3 mm, width 5.2 mm, length to width 1.6. Large, deep punctae medially to laterally, coalescing in dorso-lateral area; punctae and tubercles evenly distributed. Tubercles small but variable, with tubercles largest dorsolaterally, smallest medially. Vestiture hispid, shiny surface with some alutaceous lines present, the lines intercepting margins of tubercles. Elytra slightly expanded basally, planate from base to disc; elytral apex oval, gradually sloping. Epipleura 0.65 mm wide at base without evident punctae, with fine sparse tubercles becoming absent basally, lacking an alutaceous network; basal width expanded compared to preabdominal width, humeral area obtuse, humeri slightly angled.

Venter. — Abdomen with moderate, shallow punctae; tubercles present on second visible sternite on shiny surface. Foreleg in anterior silhouette with distal, ventral surface of femur straight; tibia with proximal, ventral border not constricted, long, ratio 1.05; ventrodiscal surface of probasitarsus not produced.

Secondary sexual characteristics. — Male with setal pad on probasitarsus short, ratio 0.41; fine setae present in plantar groove of second protarsal segment. Lacking fine golden setae in plantar groove of first segment of mesotarsus. Female with coarse black setae on plantar surface of probasitarsus distributed as two loosely consolidated lateral rows. Parameres as in figure 7, 8.

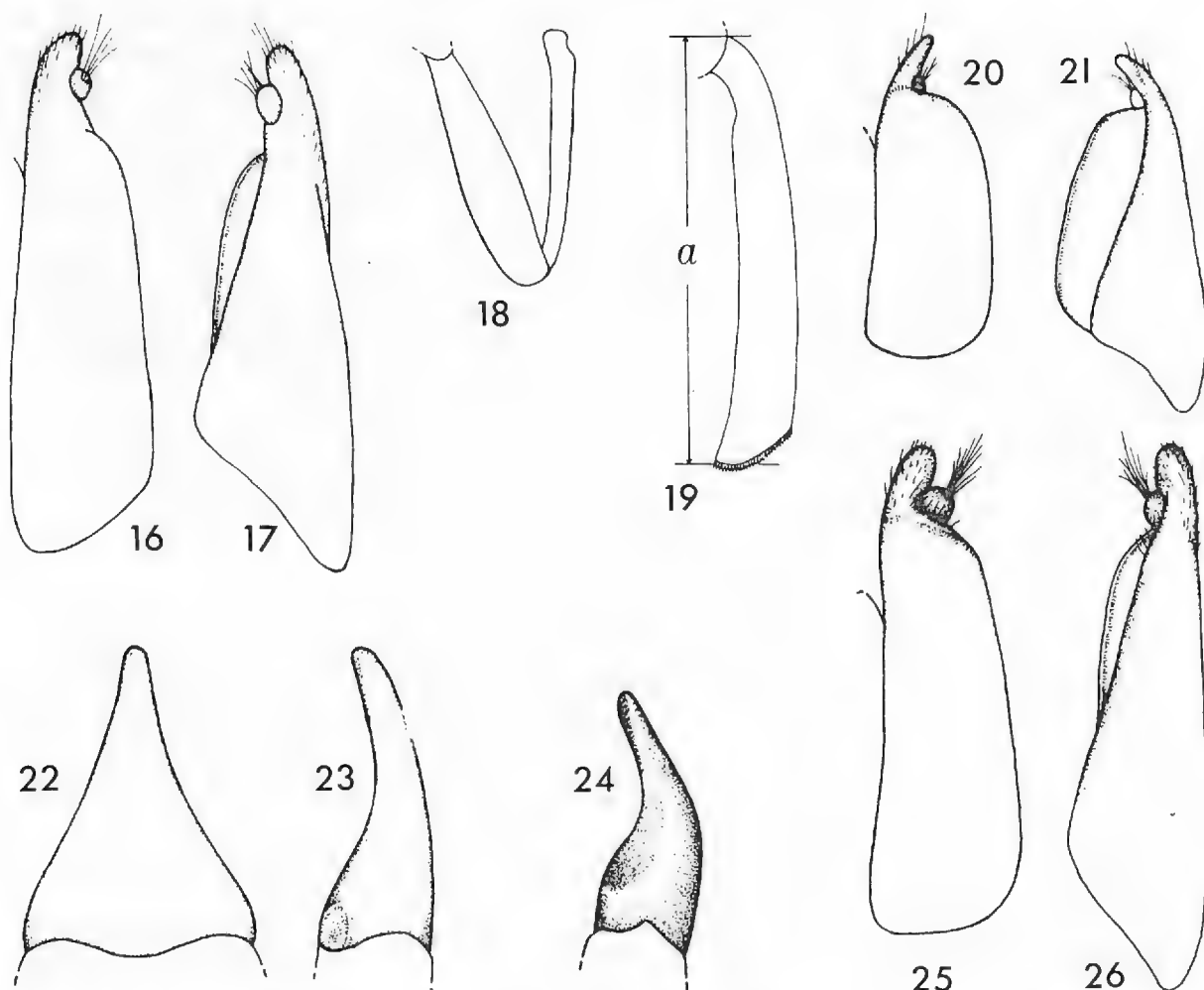
Comments. — The species is named after the type of mountain on which the specimens were initially found. This species may represent a geographic variant of *robinetti*, but is dissimilar enough to warrant species status at this time.

Ecology and distribution. — Examples were taken in June and July in Lassen and Crater Lake National Parks.

Specimens examined. — 3 males. California: Lassen National Park; Oregon: Klamath County, Crater Lake National Park.

***Eleodes orophilus*, new species** (Figs. 2, 22, 23, 25, 26)

Diagnosis. — This species is most similar to *E. snowi* Blaisdell from which it is differentiated by having the pronotal apical angles obtuse; by having a basal constriction of the pronotal disc; by lacking tubercles in the basal half of the propleura; and by having fewer, smaller tubercles over the elytral disc, with an alutaceous network of lines which give the surface a slightly rugose appearance. Males of *orophilus* differ from the respective sex of *E. horni* Blaisdell, *E. lecontei* Horn, *E. hoppingi* Blaisdell, *E. patulicollis* Blaisdell, and *E. tenebrosus* Horn by having the proximal, ventral border of the protibia moderately constricted.



Figs. 16-26 *Eleodes (Blapyllis)* sp.; genitalia and leg parts: Figs. 16, 17, *E. panamintensis* new species: dorsal view; ventral view of valvula, respectively of topotype. Fig. 18, 19, *E. volcanensis* new species: foreleg; tibia, respectively of holotype; Fig. 20, 21, *E. wake-landi* new species: dorsal view; ventral view of valvula, respectively of holotype; Fig. 22, 23, *E. orophilus* new species: dorsal view, lateral view of parameres, respectively of holotype; Fig. 24, *E. rotundipennis* lateral view of parameres from Sunrise Park, Pierce Co., Washington; Fig. 25, 26, *E. orophilus* new species: dorsal view; ventral view of valvula, respectively of topotype.

Holotype male — CAS Type No. 11,438, exemplar female and 33 male, 35 female paratypes at base of Humphrey's Peak, San Francisco Peaks, 2900 m, Coconino County, Arizona, August, collected by Snow (no additional data). Holotype and seven paratypes, California Academy of Sciences, San Francisco; 2 paratypes, University of Arizona, Tucson; 59 paratypes, University of Kansas, Lawrence. Features of exemplar female which differ from holotype are included in parenthesis.

Head. — Eyes with lateral surface slightly convex posteriorly; genal process of moderate length (short); median lobe of mentum rounded, exposing lateral lobes.

Prothorax. — Notum (Fig. 2) 3.8 mm (4.3 mm) long, 5.2 mm (6.1 mm) wide; punctae small, moderately deep; tubercles present next to margin, vestiture inconspicuous and not noticeably hispid laterally, surface shiny. Anterior emargination moderate, apical angles obtuse; anterior width of pronotum slightly smaller than posterior width; lateral margin arcuate, non-angulate, basal constriction weakly developed; convexity (as seen in cross section) moderate (strong) with lateral fourth slightly deflexed (evenly arcuate). Pleura with punctae not evident, tubercles small, with large tubercle-free area near base of pleura, vestiture hispid on shiny surface. Prosternal process reduced.

Elytra. — Length 10.4 mm (11.6 mm), width 6.4 mm (8.2 mm); length to width 1.6 (1.4). Moderately large, deep punctae present medially to laterally, coalescing in dorsolateral area; punctae and tubercles evenly distributed. Tubercles small (minute), but variable-

in diameter with largest present dorsolaterally, smallest dorsally; vestiture pilose, surface shiny with alutaceous lines intercepting margins of tubercles. Elytra slightly expanded basally; planate from base to disc, elytral apex subobtuse, gradually sloping. Epipleura 0.82 mm (1.03 mm) wide at base with faint shallow punctae, fine tubercles sparse to absent basally, surface conspicuously alutaceous (subalutaceous); basal width moderately expanded compared to preabdominal width; humeral area obtuse, humeri rounded (slightly angled).

Venter. — Abdomen with small, shallow punctae; tubercles present (incipiently present) on second visible sternite with shiny surface. Foreleg in anterior silhouette with distal, ventral surface of femur sinuate (slightly sinuate); tibia with proximal-ventral border moderately constricted (not constricted), moderately long, ratio 0.94 (short 0.80), distal, ventral surface of probasitarsus not produced (slightly produced).

Secondary sexual characteristics. — Male with setal pad on probasitarsus short, ratio 0.50; fine golden setae present in plantar groove of second protarsal segment, absent in plantar groove of first segment of mesotarsus. Female with coarse black setae on plantar surface of probasitarsus distributed as strongly projecting bundle. Parameres figure 22, 23; valvifer 2, figure 25, 26.

Comments. — The name *orophilus* is derived from *oro*, Greek for mountain and *phil*, Greek for loving. This species is commonly found in mountainous areas. The basal constriction of the pronotal disc is occasionally absent to usually slightly sinuous. Many examples of *orophilus* were previously determined as *E. snowi* by Blaisdell.

Ecology and distribution. — High mountains of Arizona and New Mexico occurring abundantly in open stands of quaking aspen, becoming rare in pine forests at lower elevations. Specimens were taken from 1990 m to 3200 m. They are particularly sensitive to dessication as are other *Blapyllis* that occur in cool, damp habitats. Examples were taken in June, July and August.

Specimens examined — 244 males, 215 females. Arizona: Apache County, Aspen Springs, Big Lake, McKays Peak (near McNary), White Mountains; Coconino County, Flagstaff, Grand Canyon, Mormon Lake, Mud Spring, Mormon Mountain, Oak Creek Canyon, San Francisco Peaks, base of Humphreys Peak, Snow Bowl, Williams; Gila County, Payson, Pinal Mountains; Graham County, Geronimo; Arizona records not assigned to county, S. Arizona, Colorado River; New Mexico: Catron County, Apache National Forest; Sierra County, Black Range Mountains; Socorro County, Bear Trap Camp, 28 mi. SW Magdalena, Magdalena.

Acknowledgments

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**An Example of Aggregation in the
Scaphinotus Subgenus *Brennus* Motschulsky**

(Coleoptera: Carabidae: Cychrini)

David H. Kavanaugh

California Academy of Sciences, San Francisco 94118

On June 20, 1975, while collecting on the shores of Nicasio Reservoir, northern Marin County, California, Paul Choate and I encountered an extremely large aggregation of beetles referable to genus *Scaphinotus* subgenus *Brennus*. Some details relating to this event appear to be of biological significance and therefore worth reporting here.

While working up a low, open grassy knoll about 50m from the water, we found a large, partially-embedded oak log (approximate diameter 60cm, length 2.5m) with much of its bark intact. Soil under the log was slightly moist, but otherwise the area was quite dry. With considerable effort we rolled the log, just at dusk, and quickly collected a few individuals on the ground and underside of the log. Slow removal of the bark revealed several more individuals as well as the hollow interior of the log. Even in the dim light and without flashlights, we could see that the entire inner cavity was packed with beetles. We began collecting these individuals as total darkness approached, quickly filled all our collecting vials, then resorted to stuffing the beetles alive into our clothing. We noted that all individuals were very sluggish, slow to react to disturbance, at a time when these nocturnal animals would be expected to begin heightened activity. Only after several minutes were individuals roused to movement. Eventually many individuals escaped into the grass as we collected; but a larger number remained in the log when we could no longer see to collect.

Together, we collected over 130 specimens from the log; and I was surprised to find that three species were represented in the collection: *Scaphinotus interruptus* Menetries, *S. striatopunctatus* (Chaudoir), and *S. ventricosus* Dejean. If, conservatively, 30 percent of the massed individuals escaped capture, then the aggregation contained about 200 individuals. The significance of this large number can only be appreciated by comparison with the usual collection pattern. For example, a good day of collecting in suitable habitat might yield 10 to 20 of these large, conspicuous beetles if every rock and log over an area of perhaps 5000 to 10000 square meters were turned. While such a crude method of sampling may not reliably estimate or even reflect population densities in these beetles, and although no actual data on population densities in these species exist, it seems reasonable to

assume that the numbers of individuals in the aggregation represented substantial percentages of the populations normally ranging over a much greater area, perhaps over many thousand square meters. Relative numbers of individuals collected representing each species were roughly the same as would be expected through hand-collecting in the manner discussed above. Individuals of *S. interruptus* are at least twice as commonly collected as those of each of the other two species. In my material, relative numbers were as follows: 46 *S. interruptus* (21♂♂:25♀♀); 22 *S. striatopunctatus* (11♂♂:11♀♀); and 13 *ventricosus* (5♂♂:8♀♀). Choate collected 25 *S. interruptus* and about the same number for the other two species combined.

A few observations on aggregation in *Scaphinotus* species appear in the North American literature; but these report aggregations of relatively small size and single species. Nicolay (1913) found individuals of *S. (Irichroa) viduus* Dejean clustered together under loose bark at the base of a tree in the Catskill Mountains of New York. Pratt (1938) found 17 *S. (Stenocantharis) angusticollis* (Mannerheim) individuals together under adjacent boards on Whidby Island, Washington in May 1938; and I have found (unpublished field observations) numerous equivalent aggregations of members of this species in western Washington. Greene (1975) found repeated small aggregations of *S. (Pseudonomareetus) manni* Wickham individuals under the same stone during April and/or May, 1971 and 1973 in southeastern Washington. Two more impressive but unpublished accounts can also be mentioned here. R.T. Bell (personal communication) discovered an aggregation of 47 *S. (Brennus) marginatus* (Fischer von Waldheim) individuals in a single log in early July, 1973 near Corvallis, Oregon; and G. E. Ball (personal communication) similarly found 75 individuals, a mixture of *S. marginatus* and *S. angusticollis*, together in late July or early August, 1955 in southwestern British Columbia.

In comparison to previous observations, the aggregation Choate and I discovered appears to have been relatively large and unusual in its multi-species composition. Several questions concerning this massing of individuals immediately come to mind. How did this large aggregation form? What were the beetles doing there and how long might they have stayed *en masse*? Why were three species represented? Assuming that this particular aggregation was not unique, and that at least some level of aggregation occurs with some frequency in these species, what biological significance can we attribute to the phenomenon? Although data which might rigorously support answers to these and other questions are lacking, a brief discussion here may provide some tentative answers and, hopefully, stimulate others to begin ecological and populational studies on these fascinating animals.

Three possible mechanisms by which the aggregation could have formed are: (1) independent, individual response to an environmental

gradient (or gradients) leading to aggregation in an environmentally (abiotically) optimum location; (2) individual response to some stimulus (or stimuli) provided by other individuals, leading to aggregation at a common location; or (3) a combination of the first two. The third choice seems most likely with (1) and (2) involved (in that order) sequentially. *Scaphinotus* beetles are usually found in cool, moist conditions and, in late June, such suitable areas are limited and isolated. I assume that the beetles normally follow moisture and temperature gradients in seeking suitable areas and that this common search would bring individuals together. At Nicasio Reservoir, however, much suitable cover exists in the form of large logs along the shores and ridges. A search of the area uncovered, in addition to the large aggregation, a few scattered individuals and aggregations of two to four individuals. From my casual observations, the log containing the large aggregation was in no way unique (in the microhabitat it provided or in its location) in proportion to the uniqueness of the aggregation it contained. Therefore, it seems unlikely that mechanism (1) alone can account for this aggregation.

Greene (1975), citing the work of Wautier (1971) on *Brachinus* spp., implied that the repeated aggregations he observed in *S. manni* may have formed in response to an "attractive odor" present at the aggregation site. *Scaphinotus* beetles are easily recognized by their very strong, omnipresent odor; and individuals of many species all seem to have the same odor. The source of the volatile chemical(s) detected is probably the pygidial defense gland. Beetles kept alive in culture maintain this distinctive scent even when left undisturbed, and their cages retain the same odor even after the beetles have been removed. Further observations of individuals in culture and in the field indicate a strong preference for close physical contact among individuals. I suggest that individuals are attracted to each other, probably through response to the defensive secretion. The influence of some special sex pheromone seems less likely because equal numbers of males and females were collected for all species. Once individuals make contact, their association is reinforced by positive tactile response. As the size of the aggregation increases, the *collective odor* of the mass should serve as an increasingly more powerful attractant to unassociated individuals (further augmenting the aggregation) and repellent to potential predators (see Greenslade, 1963).

S. interruptus, *S. striatopunctatus*, and *S. ventricosus* are the only cychrine species which occupy the oak woodland/savannah habitats around Nicasio Reservoir. Because relative numbers of individuals of each species collected from the aggregation reflected relative numbers normally obtained by hand-collecting in the area, the site appears to have functioned as a simple aggregation point for available individuals independent of their species identity. Although Gidaspow (1968), in her revision of subgenus *Brennus*, did not explore

or even discuss phylogenetic relationships among these species, they appear to be quite closely related. Perhaps their respective defensive chemicals are structurally similar or identical, thereby permitting shared positive responses and the resultant multi-specific aggregation.

From several lines of evidence, these three *Brennus* species appear to be similar in life cycle timing to each other and to the five cychrine species Greene (1975) studied. The phenology outlined here summarizes my own field observations and collections over the past ten years and additional data associated with specimens in the California Academy of Sciences collections. In the San Francisco Bay area, larvae of these species are collected in December through May, teneral adults in March through June. Fully-pigmented adults appear to be most active in late Spring (April and May) and again in Autumn (late September through November), with irregular activity in Winter and early Spring and no apparent activity during the hot, dry Summer (June through early September).

As mentioned above, the beetles were immobile and unresponsive to considerable agitation when discovered. Both seasonal timing of the event and behavior of the beetles suggest a Summer diapause, aestivation, for these three species, with release from diapause coincident with the return of more favorable Autumn conditions [but possibly triggered by change in photoperiod (see Thiele, 1969)]. Dissociation of the aggregation seen would then have been expected in Autumn with the resumption of adult activity.

The following timetable for various adult activities in these species seems to fit the combination of observations and suppositions presented above. Adults emerge from the pupal stage in early Spring and feed while conditions remain favorable. Coincident with warming and drying trends, adults seek suitable aestivation sites with approaching Summer. Individuals may be aided in this search by their attraction to groups of other individuals already occupying large suitable sites. Aggregation may then be viewed as an aid to adult survival through the Summer. Maturation in both sexes probably takes place during the aestivation period (see also Greene, 1975). In Autumn, resumed activity includes mating and oviposition as well as locomotion and dissociation of the aggregation. Aggregation prior to aestivation may well aid in mating success by concentrating individuals of both sexes in a limited area subsequent to the feeding period (avoiding intensified competition for food) and prior to the mating period.

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ZOOLOGICAL NOMENCLATURE

The following Opinions have been published recently by the International Commission on Zoological Nomenclature, ITZN 59.

- Opinion No. 1055 (Bull. zool. Nom. 33 (1) page 11) *Gryllus hieroglyphicus* Johannes Mueller (Physiologist) 1826 (Insecta: Orthoptera): suppressed under plenary powers in favour of *Decticus hieroglyphicus* Klug, 1832.
- Opinion No. 1058 (Bull. zool. Nom. 33 (1) page 22) *Papilio actaeon* Fabricius, 1775 (Lepidoptera) suppressed under plenary powers in favour of *Papilio acteon* von Rottemburg, 1775.
- Opinion No. 1062 (Bull. zool. Nom. 33 (1) page 31) *Anobium* Fabricius, 1775: *Grynobius* Thomson, 1859: *Priobium* Motschulsky, 1845 (Coleoptera) designation as type-species of *Ptinus punctatus* de Geer, 1774, *Anobium excavatum* Kugelann, 1791, and *Anobium carpini* Herbst, 1793, respectively.
- Opinion No. 1064 (Bull. zool. Nom. 33 (1) page 36) *Ptenura* Templeton, 1844: *crystallina*, *Podura*, Muller, 1776 (Collembola) suppressed under plenary powers in favour of *Heteromurus margaritarius* Wankel, 1860.

The Commission cannot supply separates of Opinions.

A New Genus of European Cleridae¹

(Coleoptera)

William F. Barr

University of Idaho

In the most recent catalogue of the Cleridae (Corporaal, 1950), two Old World and 14 New World species of *Orthopleura* Spinola are recognized. After studying the type-specimens of nearly all these listed species, I have concluded that a number of taxonomic changes are necessary for the group. Most of these changes will be effected in a revisional study (Barr, in press). One change is presented here: the generic separation of the Old World species from those of the New World. Since a generic name that can be used to accommodate the Old World species is not available in the literature, a new name is proposed.

Aporthopleura, new genus

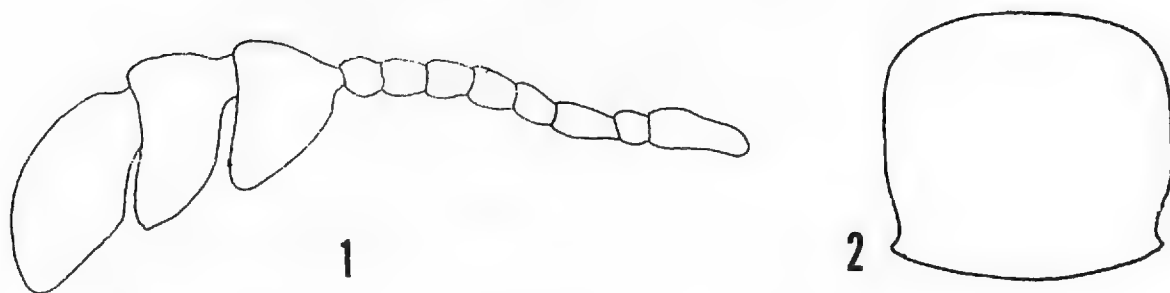
Enopliini, *Head*, excluding mouthparts, transverse; distance between eyes approximately twice the diameter of an eye across front; eyes moderate in size, finely faceted, shallowly emarginate behind antennal insertion; antenna (Fig. 1) 11-segmented, segment 1 enlarged apically, twice as long as subglobular segment 2, segments 3—8 subcylindrical, segment 3 longest, succeeding segments gradually becoming shorter, segments 9—10 abruptly enlarged, subequal, subcylindrical in cross section, triangularly transverse, segment 11 slightly shorter than combined length of segments 9 and 10, outer margin arcuate, inner margin feebly expanded or broadly angulate near middle; maxillary and labial palpus with last segment cylindrical. *Pronotum* (Fig. 2) subquadrate, approximately four-fifths as long as broad, evenly convex; lateral margins entire, continuous with anterior and posterior margins, feebly arcuately sinuate in dorsal view, slightly expanded anteriorly in side view; hind angles bluntly toothed. *Elytra* elongate, subcylindrical, parallel-sided, attaining penultimate abdominal segment; basal half with a few, coarse, more or less serially arranged punctures, that abruptly terminate at middle; epipleuron narrow, evident on basal half. *Anterior coxal cavities* open behind. *Abdomen* with six visible sternites. *Legs* short; protibia not serrate along front margin or apically toothed; tarsal segments 1—3 moderately expanded apically, each with an apical ventral plantula; pretarsal claws with a broad, blunt basal tooth.

Type of genus: *Dermestes sanguinicollis* Fab.

Aporthopleura is separated from *Orthopleura* by having a more compact and much less flattened antennal club, the pronotum bluntly toothed at the hind angles and less strongly expanded on its lateral margins, and the elytra very sparsely and coarsely punctured on the basal half.

Aporthopleura shows affinities with the Old World genus *Enoplium* Latreille (typified by its type-species *E. serraticornis* (Fab.)), especially with regard to thoracic structure, open front coxal cavities, and perhaps elytral punctation. However, *Aporthopleura* differs from *Enoplium* by the nature of the antennal club, the toothed pretarsal claws, and the nonexpanded terminal segment of the palpi.

¹Published with the approval of the Director of the Idaho Agricultural Experiment Station as Research Paper No. 7666.



Figs. 1—2. *Aporthopleura sanguinicollis* (Fab.). Fig. 1. Antenna. Fig. 2. Dorsal view of pronotum.

This genus is established to receive the old, well-known European species *O. sanguinicollis* (Fab.) and *O. funebris* Fairmaire which was described from Syria. The type-specimen of this latter species has not been located nor have any determined specimens been examined. Under the circumstances, its placement in *Aporthopleura* must be considered tentative.

Literature Cited

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SCIENTIFIC NOTE

***Dermestes medialis* Casey a synonym of *Dermestes tristis* Fall.** — *Dermestes tristis* Fall, 1897 (Canad. Entom., 29:237,244), is recognized by the color of its dorsal pubescence, which is entirely black except for the presence of 3 spots of white pubescence on the disc of the pronotum. Occasionally there may also be a few other scattered white hairs on the pronotum. Specimens answering this description are known from Southern California north to British Columbia and west into Nevada, Idaho, Alberta, and Northern Colorado. *Dermestes medialis* Casey, 1900 (Jour. N.Y. Entom. Soc., 8:141), was established for a specimen with totally black pronotal and elytral pubescence. Forms similar to the type specimen are found at scattered localities in central California. In the same area and at other localities throughout the range of *D. tristis* specimens are found with the pronotal spots of white pubescence reduced to a very few white hairs. It is the opinion of the authors that the two names are synonyms and that the forms with all black pubescence represent a poorly defined geographical race of *D. tristis*. Thus we hereby make the following nomenclatorial proposal: *Dermestes tristis* Fall, 1897 (= *Dermestes medialis* Casey, 1900). — R. S. BEAL, JR., Northern Arizona University, Flagstaff 86001 and T. N. SEENO, California Department of Food and Agriculture, Sacramento 95814.

Revision of the Scarabaeidae: Anomalinae
2. An Annotated Checklist of *Anomala* for the
United States and Canada
(Coleoptera)

Robert W. L. Potts

California Academy of Sciences, San Francisco, California

It has been 60 years since the last general study was published for the *Anomala* of our area. The review by Thomas Casey in 1915, while in key form, was scarcely helpful in identification. Basic keys to the species were those of Horn (1884), and Schaeffer (1907). The few subsequent studies have been limited in scope, or only descriptions of new species.

In our study we reviewed all original descriptions, and in order to simplify direct comparisons with specimens and related species, we rearranged these to follow a standard form. We examined the Schaeffer and Casey Types¹, and also Types or Co-types of the Bates and Wickham species. Finally, we identified or re-identified specimens from 30 collections, totalling well over 12,000 specimens.

Of the more than 80 names applied or mis-applied to *Anomala* in our area we accept only 33 as valid, with 2 further names applied as subspecies. Our study adds 7 new species and 3 new subspecies. The following checklist gives the necessary changes in synonymy, and also lists States and Provinces from which specimens were seen.

A study of this nature must always depend on the very generous and much appreciated assistance of a considerable number of institutions and individuals: California Academy of Sciences (Hugh Leech); California Department of Agriculture (Fred Andrews); California State University, Long Beach (Eric Fisher); Canadian National Collection (Henry Howden); North Dakota State University (Richard Post, Paul Lago); Oregon Department of Agriculture (Richard Westcott); Oregon State University (Paul Ritcher, Dave Carlson); Southwestern Research Station (Vincent Roth); Texas A & M University (Horace Burke); Texas Tech University (Charles O'Brien); U.S. National Museum (Robert Gordon); University of Arizona (Floyd Werner); University of California, Berkeley (John Chemsak); University of California, Riverside (Saul Frommer); University of Georgia (Robert Turnbow, Jr.); University of Nebraska (Brett Ratcliffe); University of Wisconsin (Lutz Bayer). In addition, I am most grateful for the loan of personal collections from Rolf Aalbu, John Baker, Dave Carlson, Claude

¹Casey did not designate types. This was done subsequently by L. L. Buchanan while rearranging the Casey collection when it was incorporated into the National Museum collection, but the designations were not published. Casey described most of his proposed taxa from single specimens, which should be Holotypes, but Lectotypes should be selected in the other cases, and the data should be published to meet the requirements of the International Code. We considered this impossible without a visit to the National Museum to consider the entire Casey collection of Anomalinae.

Chantal, Joseph Cicero, Alan Hardy, Henry Howden, Ron McPeak, Gayle Nelson, Brett Ratcliffe, Robert Turnbow, Jr., Norman Woodley, and Robert Woodruff. Also, I am particularly indebted to Joe Cicero for sharing his extensive knowledge of collecting sites through the Southwest, and to Alan Hardy for assistance in numerous ways, including taking us into the dunes at Glamis, and furnishing a number of references.

Annotated Checklist of *Anomala* of the United States and Canada

***Anomala adscita* (Robinson) 1941:132. New Combination.**

Rhombonalia adscita Robinson 1941:132.

Distribution: AZ, Coconino Co.

***Anomala antennata* Schaeffer 1906:1.**

Distribution: southern NM, western TX.

***Anomala arida* Casey 1915:29.**

The female of these first three species and of a considerable number of the species that follow has not been described. However, in the Anomalinae the female often differs only in the sexual characters, such as the antennal club, protibiae, and larger protarsal claws, otherwise fitting well within the range of variation. Even though so many species were described from a single sex, usually the male, it would seem pointless to attempt meaningful description, or to designate types in all these cases.

Distribution: southern AZ.

***Anomala binotata* (Gyllenhal) 1817:106.**

Melolontha binotata Gyllenhal 1817:106.

Euchlora maculata Laporte 1840:136.

Anomala unifasciata Say 1825:199.

Anomala marginella LeConte 1854:81.

Anomala compacta Casey 1915:15. **New Synonymy.**

Distribution: AL, AR, CO, CT, DE, DC, GA, IL, IN, IA, KS, KY, LA, MD, MI, MN, MO, MS, NB, NJ, NY, NC, OH, OK, PA, RI, SC, TN, TX, VA, WI, and Ontario. (Leng record for NM was a mistake. It applied to *marginella* and LeConte clearly stated the specimens were from WI, even though it was described in a paper on species from the Mexican border.)

***Anomala butleri* (Howden) 1955:258. New Combination.**

Rhombonalia butleri Howden 1955:258.

Distribution: AZ, Dragoon Mountains.

***Anomala carinifrons* Bates 1888:249.**

Anomala camancha Wickham 1913:29. **New Synonymy.**

Only one of six Cotypes in the Wickham series has a moderately impressed clypeal suture, while the others vary from slightly to not at all impressed. Wickham's unequivocal "deeply impressed" is extremely misleading, and does not constitute a real difference.

The female is distinctive and has not been previously noted: similar to male in coloration and sculpture except the clypeus is nearly evenly rounded, without anterior truncation, nearly in same plane as frons but separated by a thin raised carina at suture, crowded punctures larger, more distinct. Pronotum more sparsely, less strongly punctate. Pygidium with only faint indication of punctures and incised strigulae.

Antennal club notably ovate, not contorted, about length of stem. AZ, Cochise Co., Douglas, 8 Aug. 68, in author's collection. (Another female in USNM with clypeal suture not as carinate, another in Cicero Coll. with suture perfectly flat.)

Distribution: southeastern AZ, southern NM, western TX.

Anomala carlsoni Hardy 1976:365.

Distribution: So. CA.

Anomala castaniceps Bates 1888:248.

Anomala lurida Horn 1884:161, in part.

This species was confused with what is now *nimbosa* Casey, and both were included by Horn under the invalid Fabrician name, *lurida*, which is also sometimes ascribed to Burmeister.

Distribution: southern AZ.

Anomala cavifrons LeConte 1868:52.

Anomala apacheana Wickham 1913:30. **New Synonymy.**

Rhombonalia comes Casey 1915:6. **New Synonymy.**

Rhombonalia cochiseana Casey 1915:7. **New Synonymy.**

Rhombonalia transversa Casey 1915:7. **New Synonymy.**

Casey had a genius for describing the superficial characters most likely to be widely variable, using comparatives with abandon that had little or no precise meaning. Wickham, however, avoided comparing non-existent differences by an interesting sleight of hand switch, comparing *apacheana* with *camancha*, a synonym of the quite different *carinifrons*, rather than with *cavifrons*.

Distribution: AZ, CO, KS, NB, NM, OK, TX.

Anomala delicata Casey 1915:27.

Anomala centralis Horn 1884:159, in part.

Anomala inconstans Schaeffer 1906:2, in part.

Anomala moquina ♂ Casey 1915:31. **New Synonymy.**

Anomala papagoana Casey 1915:30. **New Synonymy.**

Both Horn and Schaeffer failed to recognize the species was different, mistakenly including it with previously described valid species. It is our most variable and widespread Southwestern species, and Casey compounded confusion by attempting to describe it as three species. It seems unfortunate that *delicata* is the first of these, as the typical specimen is far from delicate. Casey's *moquina* was described from an alleged pair, the male a synonym here, the quite different female belonging to *digressa* Casey.

Distribution: southern AZ, from Baboquivari Mtns. east, southern NM, western TX.

Anomala diabla Potts 1976:220.

Distribution: central Rio Grande River Basin, TX.

Anomala digressa Casey 1915:27.

Anomala sagax Casey 1915:30. **New Synonymy.**

Anomala moquina ♀ Casey 1915:31. **New Synonymy.**

Distribution: middle and southern AZ.

Anomala dubia (Scopoli) 1763:3.

Scarabaeus dubia Scopoli 1763:3.

Distribution: NJ (introduced from Europe).

Anomala ellipsis Casey 1915:15.

Anomala luteipennis Horn 1884:159, in part.

Horn again failed to recognize a new species and included it with the *luteipennis*

of LeConte.

Distribution: south-central AZ, western NM.

Anomala exigua (Schwarz) 1878:362.

Strigoderma exigua Schwarz 1878:362.

Distribution: FL, Sumter Co. (Probably extinct; has never been collected again.)

Anomala eximia Potts 1976:221.

Distribution: FL, Highlands Co.

Anomala flavilla Bates 1888:227.

Anomala parvula Horn 1884:158, in part.

Anomala tenera Casey 1915:37. **New Synonymy.**

Anomala flavilla centralis, Saylor 1948:354.

Casey's attempt to separate *tenera* is difficult enough to understand, but then Saylor completely misidentified the species and applied LeConte's name, *centralis*, to it even though *flavilla* is a distinctive species that couldn't possibly fit LeConte's original description of *centralis*.

Distribution: CA and AZ, lower desert areas.

Anomala flavilla coachellae, new subspecies.

Holotype male and Allotype: very similar to *flavilla* in all respects except the pronota immaculate or nearly, without the well-developed paired dark maculae of the typical subspecies. (Variation in 59 male, 22 female paratypes ranges from the immaculate to showing faint or small paired maculae with one or two possibly indistinguishable from the typical.)

Holotype and Allotype: CA, Riverside Co., Coachella, 13—14 May 1917, E. P. VanDuzee, Collr. (CAS). Paratypes all from CA, Riverside Co., the following localities: 3♂, 1♀, Coachella, 27 May 1928, E. C. VanDyke, Collr. (CAS); 12♂, 5♀, SW Coachella, May—June 1973, 1974, H. Cousins, Collr. (Potts); 17♂, 7♀, Coachella Valley, 31 May 1962, Neal, Collr. (OSU); 2♂, same except 31, June 1962 (OSU); 9♂, 7♀, Indian Wells, 4 May 1957, R. Westcott, Collr. (ODA); 1♀, Indio, 1 June 1939, E. Ross, Collr. (CAS); 1♂, Palm Desert, 22 May 1970, A. Hardy, Collr. (Hardy); 1♂, Boyd Desert Res. Center, 15 May 1969, Frommer & Le Pre, Collrs. (UCR); 8♂, 1♀, Palm Springs, 29—30 May 1954, Menke & Stange (Woodruff); 1♂, same except 22 May 1955 (Woodruff); 2♂, Palm Springs, 30 May 1939, E. Ross, Collr. (CAS); 1♂, 2 mi. S. Palm Springs, 2 June 1968, F. Hovore, Collr. (OSU); 2♂, 1000 Palms Canyon, 21 Apr 1974, Cicero, Collr. (Cicero). Holotype and Allotype in Calif. Acad. Sci.; paratypes there also, and in the collections of Oregon Dept. Agric.; Oregon State Univ.; Univ. Calif., Riverside; J. M. Cicero; Alan Hardy; Robert Woodruff; Gayle Nelson, and the author.

Within California and Arizona *flavilla* never becomes very darkly and broadly marked as it does south to Central America, but the immaculate segment of the population, at the extreme northern limits of its distribution, appears geographically isolated north of the Salton Sea.

Anomala flavipennis Burmeister 1844:249.

Anomala dichroa Melsheimer 1844 (1845):140.

Anomala flavipennis modulata Casey 1915:23. **New Synonymy.**

Anomala flavipennis amissa Casey 1915:24. **New Synonymy.**

Typical *flavipennis* are distinguished as most commonly with pronotum moderately dark red-brown, elytra lighter reddish-yellow-brown except striae punctures sometimes red-brown, punctures of intervals paler or not colored; varying to pronotum brownish or greenish black to black, sometimes a slight metallic gloss, sometimes elytra somewhat clouded darker, usually as diffuse spots or streaks; averaging 10—12 mm.

Distribution: AL, AR, FL, GA, IL, IN, KS, LA, MD, MS, NB, NJ, NM., NC, OH, OK, SC, TX, and VA.

***Anomala flavipennis aransas*, new subspecies.**

Holotype male: pronotum blackish, elytra smoky-brown with punctures of intervals equally as strongly colored as those of striae; 10—12 mm. Holotype and 9 male paratypes; TX, Aransas Co., Goose Island State Park, 14 June 1968, J. R. Heitzman, Collr. (Woodruff). Holotype in collection of Robert Woodruff, on permanent loan to Calif. Acad. Sci.; paratypes in collections of U.S. Nat. Museum, Robert Woodruff, and the author.

***Anomala flavipennis luteipennis* LeConte 1854:80.**

Anomala luteipennis LeConte 1854:80.

Anomala stigmatella Casey 1915:22. **New Synonymy.**

Anomala kansana Hayes & McColloch 1924:138. **New Synonymy.**

Casey redescribed specimens from Kansas in which spots of the 3rd and 5th elytral intervals were elongated into streaks, and subsequently Hayes & McColloch re-redescribed specimens from the same area with the same elongated streaks, thoroughly confusing the identification of this subspecies.

The typical variation is: pronotum dark red-brown to black, sometimes faintly metallic; elytra with dark brown to black maculations on a more yellowish ground color as spots, streaks or cloudings, particularly on 3rd and 5th intervals, but varying widely from obsolescent to entirely dark brown-black, however darker specimens often with pale band posterolaterally and paler streakings through disc, lighter specimens with strial punctures moderately colored, sometimes forming distinct thin lines, punctures of intervals less strongly or not colored: 9—13 mm.

Distribution: KS, NB, OK, TX.

***Anomala flavipennis okaloosensis*, new subspecies.**

Holotype male: pronotum dark brownish-black, elytra immaculate yellowish brown, with strial punctures uncolored or spots extremely fine, the punctures of intervals uncolored or, rarely, very finely colored; antennal club appears to be slightly longer proportionately than in the typical subspecies; 9—11 mm.

Holotype male and 2 male paratypes: FL, Okaloosa Co., Dustin, 18 May 1960, Woodruff, Collr. (Woodruff); 19 male paratypes, FL, Okaloosa Co., 5 mi. W. Miramar Beach, sand dunes, 19 May 1969, H. Weems, Collr. (Woodruff); 5 male paratypes, FL, Santa Rosa Co., Navarre Beach, grassy dunes, 23 May 1971, H. Weems, Collr. (Woodruff). Holotype in collection of Robert Woodruff, on permanent loan to Calif. Acad. Sci.; paratypes in collections of U.S. Nat. Mus., Calif. Acad. Sci., Robert Woodruff, and the author.

Anomala flavipennis subquadrata* Casey 1915:21. **New Status.*

Anomala subquadrata Casey 1915:21.

This subspecies is largely brownish-black, not distinctly bicolorous, with elytra often as dark as pronotum, at least in more or less basal half, sometimes punctures evidently colored in striae; consistently smaller, 8—10mm.

It is presently impossible to define the several subspecies on a truly sound basis, however, it is rather clear that *flavipennis* is in a greater than average state of flux, with certain localized centers of particular trends of variation, and it appears valid to recognize these populations as subspecies.

Distribution: GA, MD, NJ, VA, probably coastal or near.

***Anomala foraminosa* Bates 1888:229.**

Distribution: southern TX.

***Anomala hardyorum* Potts 1976:221.**

Distribution: CA, Imperial Co.

***Anomala imperialae* Potts 1976:222.**

Distribution: southern AZ and Imperial Co., CA.

Anomala innuba (Fabricius) 1787:22.*Melolontha innuba* Fabricius 1787:22.*Anomala minuta* Horn 1884:159.*Anomala undulata* Casey 1915:32. **New Synonymy.***Anomala innuba piceola* Casey 1915:35. **New Synonymy.***Anomala medorensis* Casey 1915:35. **New Synonymy.**

Casey completely confused the two species, *innuba* and *undulata*, although he properly referred *piceola* to *innuba*, and *medorensis* as closely related. (Also see discussion after *undulata* Melsheimer.)

Distribution: AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, MD, MS, MO, NB, NJ, NM, NC, NY, OH, OK, PA, SC, TN, TX, VA, WI, and WV.

Anomala insitiva Robinson 1938:112.*Anomala polychalca* Schaeffer 1906:2.

Schaeffer recognized the species, but placed it with a Mexican species.

Distribution: southern TX.

Anomala kanei Potts 1976:223.

Distribution: northern AZ and southern UT.

Anomala lucicola (Fabricius) 1798:132.*Melolontha lucicola* Fabricius 1798:132.*Melolontha atrata* Fabricius 1798:132.*Melolontha moerens* Fabricius 1798:132.*Anomala quadrimaculata* Drapiez 1820:276.*Euchlora nigrigula* Laporte 1840:137.*Anomala cinctella* Burmeister 1844:269.*Anomala pinicola* Melsheimer 1844 (1845):141.*Anomala phylloperthoides* Nonfried 1894:122.

Distribution: CT, DE, DC, FL, GA, IL, IN, KY, MD, MA, ME, MI, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VA, VT, and Ontario.

Anomala ludoviciana Schaeffer 1906:3.*Anomala pubescens* Blatchley 1910:984.

Distribution: IL, IN, IA, KS, LA, MN, MS, NB, ND, OK, TN, TX, and Wi.

Anomala marginata (Fabricius) 1792:164.*Melolontha marginata* Fabricius 1792:164.*Melolontha annulata* Germar 1824:121.*Spilota incolumis* Casey 1915:43. **New Synonymy.**

In many references the date of this Fabrician species has been given as 1775 rather than 1792, but this is incorrect, and the name therefore becomes a primary homonym of *Melolontha marginata* Herbst 1784:14 (now a synonym of *Rhizotrogus ruficornis* (F.)). Under the Code a new name is required, and the first synonym, *annulata* Germar, is available. However, *marginata* has been used in its present sense for 185 years, and Germar's *annulata* has stood as a synonym since 1844. It would seem both continuity and common sense suggest the preservation of the Fabrician name that has gone so long unquestioned, and the matter will be submitted to the International Commission on Zoological Nomenclature.

Casey's proposed species fits almost in the middle of the series of variation, certainly one of his least distinctive species.

Distribution: AL, AR, DC, FL, GA, IN, KS, KY, LA, MD, MS, MO, NC, NJ, OH, SC, TN, and VA.

Anomala mendica Casey 1915:20.

Distribution: FL, GA, SC.

Anomala minuta Burmeister 1844:249.

Distribution: AL, FL, GA, NC, and SC.

Anomala nimbosa Casey 1915:26.

Anomala inconstans Schaeffer 1907:69.

Anomala lurida Horn 1884:161, in part.

Horn mistakenly placed the species under an invalid Fabrician name, and Schaeffer referred it to a Mexican species. It is quite possible that it should be placed as a sub-species of *inconstans* Burmeister, but the problem will be more completely studied in our consideration of the species in Mexico.

Distribution: southern AZ and NM.

Anomala oblivia Horn 1884:163.

Spilota oblivia maritima Casey 1915:47. **New Synonymy.**

Distribution: CT, DC, FL, GA, ME, MD, MA, MI, NJ, NY, NC, PA, SC, TN, and VA.

Anomala orientalis (Waterhouse) 1875:108.

Phyllopertha orientalis Waterhouse 1875:108.

Distribution: CT, NJ, NY (introduced from Asia).

Anomala parvula Burmeister 1844:247.

Distribution: FL, GA, MS, NC, and SC.

Anomala robinsoni Potts 1974:150.

Pachystethus floridana Robinson 1941:133.

Distribution: FL.

Anomala sabinae Potts 1976:224.

Distribution: AZ, Sabino Canyon.

Anomala semilivida LeConte 1878:403.

Anomalepta flaccida Casey 1915:10. **New Synonymy.**

Distribution: AL, FL, GA, NC, and SC.

Anomala tibialis Schaeffer 1906:5.

Known from Type only, the exact locality unknown. If the species has not been driven to extinction by progress, it is likely to be found associated with a more or less sandy area in the state.

Distribution: TX.

Anomala suavis Potts 1976:225.

Distribution: TX, Winkler Co.

Anomala umbra Casey 1915:16.

Anomala servilis Casey 1915:16. **New Synonymy.**

Distribution: DE, FL, GA, MD, MS, NC, NJ, and SC.

Anomala undulata Melsheimer 1844 (1845):140.

Anomala varians Burmeister 1844:248.

Anomala undulata dubia Blatchley 1910:984.

Anomala nigropicta Casey 1915:33. **New Synonymy.**

Anomala nigropicta canadensis Casey 1915:33. **New Synonymy.**

Anomala nigropicta floridana Casey 1915:33. **New Synonymy.**

Anomala nigropicta saginatula Casey 1915:34. **New Synonymy.**

Colonel Casey was sometimes capable of making a difficult situation nearly impossible. In this case, he took Melsheimer's name, *undulata*, and completely misapplied it to a minor variant of *innuba*, so that he could redescribe the veritable, and common

undulata as *nigropicta*, quite in spite of the fact that both Horn and Schaeffer had keyed the species properly (although Horn had mistakenly applied the name *minuta* to *innuba*). Nor is there any problem with Melsheimer's original description. While brief, it distinguishes *undulata* from *innuba*.

We found a considerable number of pre-Casey identifications of *undulata* properly identified to Melsheimer's species. Also, we checked the species and its relatives in Mexico and Central America, finding them all properly related to Melsheimer's *undulata*, and not to any *innuba* form. It is really rather amazing that so many made the mistake of following Casey rather than Schaeffer, Horn, and Melsheimer, but on the other hand it is a fair indication of the fact it is easy to be misled by careless work.

Distribution: AL, AR, DE, DC, FL, GA, IL, IN, KS, KY, MD, MI, MS, MO, NJ, NC, OH, PA, SC, TN, TX, VA, WI, and Ontario.

Anomala of Baja California

It has been customary to include this area with the United States, although we see no real reason for continuing the tradition, and will treat the species more fully in the Mexican section of our study. However, to amend the record at this time for those collectors who still follow Leng's arrangement, we list:

Anomala centralis LeConte 1863:78.

Anomala raydoma Saylor 1948:354. **New Synonymy.**

Somehow Saylor also misapplied an established name, *centralis*, to *flavilla* Bates, calling it a subspecies, and then redescribed LeConte's species as new. LeConte clearly describes the triangular macula of *centralis*, a type of pronotal marking that is never even approached in *flavilla*, and Schaeffer's key is also perfectly clear in properly separating the two species.

Anomala peninsularis Schaeffer 1906:3.

Superficially similar to *flavipennis*, however distribution is much different and the large terminal articulated spine of the protibia is quite different from the extremely short and appressed spine of *flavipennis* and all its subspecies.

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Three New Gall-Inducing *Callirhytis* Foerster from *Quercus cedrosensis* Muller

(Hymenoptera: Cynipidae)

D. Charles Dailey and Christine M. Sprenger

Sierra College, 5000 Rocklin Road, Rocklin, California 95677

The cynipid fauna on the oak *Quercus (Protobalanus) cedrosensis* Muller, had not been studied since its description (Muller, 1962). *Quercus cedrosensis* occurs in only a few small, highly localized populations on the west slope of the Sierra San Pedro Martir and along the Pacific Coast, Baja California, Mexico. This paper includes three new unisexual generations in the genus *Callirhytis*.

Callirhytis cedros, new species

Unisexual Generation Female Holotype. — Head: coriaceous, sparsely pubescent; from above transverse; narrower than thorax; cheeks not broadened behind eyes; occiput raised above contour of head; malar space 0.4 times eye height, not grooved; antennae filiform, 14 segmented, segment 1 longer than 2, segment 3 less than 1 plus 2 but longer than 4, 14 slightly longer than 13. Thorax: mesoscutum with nearly contiguous setaceous punctures, setae not obscuring scutal sculpture, broader than long; anterior parallel lines distinct, 0.3 times mesoscutum length; notaulices complete, sharp edged, shiny, weak anterior of parapsides; parapsidal lines 0.6 times mesoscutum length from posterior; median groove short, weak, length less than width of area between notaulices posteriorly; scutellum rugose, pubescent; fovea smooth, bare, polished, separated by low ridge; mesopleuron anterodorsally dull, microcoriaceous, ventrally aciculate, dorsoposteriorly smooth, shiny, sparsely seto-punctate near wing. Wing hyaline, margin ciliate, veins yellow-brown, radial cell open, aerolet 0.17 times cubital cell length. Claws simple. Abdomen: propodeum wrinkled; longer than head plus thorax, two tergites visible in dorsal view with tergite II smooth, polished, micropunctate, sparsely pubescent anterolaterally; ventral spine 3 times as long as high or wide, evenly tapered, slightly bristly. Mesonotum length 0.9 times, antennae 2.1 times, and wing 3.6 times maximum head width. Length 2.4mm. Body dark red-brown, appendages brown.

Variation — Unknown. Only 2 specimens reared.

Host. — *Quercus cedrosensis* Muller.

Gall. — Detachable, monothalamous, stem or aborted bud gall. Spherical, dark brown, 6mm in diameter (Fig. 1).

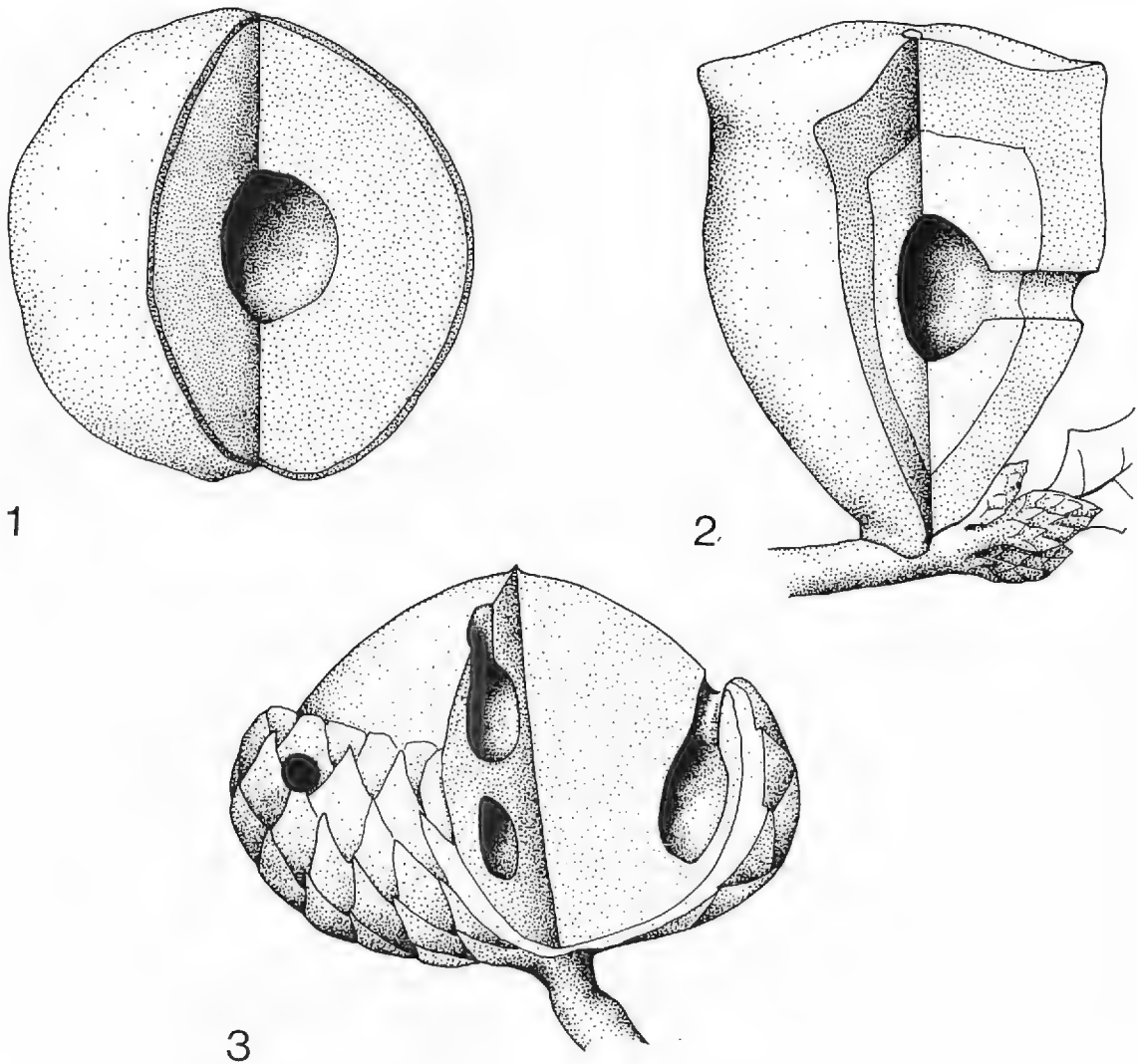
Biology. — Galls were collected in December 1973 and two insects emerged in February and March, while being maintained indoors. Oviposition site is unknown.

Distribution. — The holotype female emerged in late February 1974 from a gall collected on Cedros Island, Baja California, Mexico by David Cavagnaro in December 1973. There is no other location known for this insect.

Type deposition. — Holotype female and gall in United States National Museum. Paratype female and gall in California Academy of Science. Other paratype galls in senior author's collection.

Callirhytis cedrosensis, new species

Unisexual Generation Female Holotype. — Head: reticulate; from above transverse; slightly narrower than thorax; cheeks not widened behind eyes; occiput elevated above contour of head; malar space 0.6 times eye height, not grooved; antennae filiform, 14 segmented, segment 1 longer than 2, segment 3 longer than 1 plus 2 or 4, 14 one and one-third times length of 13. Thorax: mesoscutum weakly and irregularly rugose throughout, as broad as long, sparsely pubescent; anterior parallel lines distinct, 0.5 times length of



Figs. 1-3 Galls of *Callirhytis* spp. Fig. 1. *cedros* new species, 7 x. Fig. 2. *cedrosensis* new species, 7 x. Fig. 3. *protobalanus* new species, 9 x.

mesocutum; notaulices sharp edged, sculptured posteriorly, complete but progressively more narrow and weak anteriorly; parapsidal lines distinct, from posterior 0.5 times mesoscutum length; median groove sharp edged, 0.25 times mesoscutum length; scutellum reticulate, sparsely pubescent; fovea smooth, polished, bare, sharply outlined, separated by ridge; mesopleuron aciculate. Wing hyaline, margin ciliate, veins yellow-brown, radial cell open, aerolet 0.25 times length first cubital cell. Claws simple. Abdomen: propodeum rugose; length equal to head plus thorax, tergite II smooth, polished, bare dorsally, pubescent anteriorlaterally, ventral spine 1.5 times as long as high or wide, slightly bristly. Mesonotum length 1 times, antennae 2.5 times, and wing 5 times maximum head width. Length 3.2mm. Head, antennae, thorax, legs, and abdomen yellow-brown, abdomen darkest dorsally on tergite II; thoracic lines, except notaulices, and most sutures dark brown.

Variation. — Cedros Island specimens with reticulate sculpturing on median foveal ridge. Length of 59 specimens 2.9-3.5mm, average 3.3mm.

Host. — *Quercus cedrosensis* Muller.

Gall. — Detachable, monothalamous, stem galls. Flat-topped, with small elevated central disk, ovoid, green and succulent when fresh, brown to purple when dry, 0.8 to 1.5cm tall, 1.2 cm average, 1.0cm diameter. Galls collected from Cedros Island are more rounded apically and without sharply ridged flattened top (Fig. 2).

Biology. — Insects emerged in January 1972 from galls collected 30 December 1971 and maintained indoors. The location of the galls suggests that the eggs must have been

laid in terminal or axillary buds on first year wood. Oviposition site of unisexual generation is unknown.

Distribution. — The holotype female was collected 12 miles southeast of Ensenada, Baja California, Mexico by C. Dailey (#1201) 30 December 1971. Paratype galls were collected on Cedros Island, Baja California, Mexico by David Cavagnaro in December 1973 and yielded insects during February and March while being maintained indoors. Similar galls were collected 9.7 km (6 miles) southwest of San Vicente, Baja California, Mexico.

Type deposition. — Holotype female and gall in United States National Museum. Paratype insects and galls in United States National Museum (2), California Academy of Science (2), University of California — Davis (2), Weld collection in possession of R. J. Lyon at Los Angeles City College (2) and the authors' collection.

***Callirhytis protobalanus*, new species**

Unisexual Generation Female Holotype. — Head: reticulate; from above transverse; slightly narrower than thorax; cheeks widened behind eyes; occiput slightly elevated above contour of head; malar space 0.3 times eye height, not grooved; antennae filiform, 13 segmented, segment 1 longer than 2, segment 3 longer than 4 but less than 1 plus 2, 13 twice length of 12. Thorax: mesoscutum coriaceous throughout, as broad as long, sparsely pubescent; anterior parallel lines distinct, 0.5 times mesoscutum length; notaulices complete, broadest posteriorly; parapsidal lines distinct, from posterior 0.5 times mesoscutum length; median groove, short, weak; scutellum reticulate, sparsely pubescent; fovea indistinct, sculptured, not separated by a ridge; mesopleuron aciculate. Wing hyaline, margin ciliate, veins yellow-brown, radial cell closed, aerolet 0.16 times first cubital cell length. Claws simple. Abdomen: length equal to head plus thorax, propodeum smooth, polished, bare; tergite II smooth, polished, bare dorsally, sparsely pubescent anterolaterally; ventral spine long, slender, 10 times as long as high or wide, slightly bristly. Mesonotum length 1.3 times, antennae 2.2 times, and wing 3.8 times maximum head width. Length 1.8mm. Color of head, thorax, abdomen, antennae, and legs, brown; abdomen dark brown to black dorsally, parts of some pleural sutures black.

Variation. — Length of 12 specimens 1.7-1.9mm, average 1.8mm.

Host. — *Quercus cedrosensis* Muller.

Gall. — Integral polythalamous acorn gall formed in cotyledon of the acorn 1.0 to 2.0cm wide, 1.2cm average. Emergence occurs through hull and sometimes through cap (Fig. 3).

Biology. — Galls maintained indoors yielded adults 2-5 January 1972 from galls collected 30 December 1971. Oviposition site unknown.

Distribution. — The holotype female was reared from a gall collected about 12 miles southeast of Ensenada, Baja California, Mexico by C. Dailey (#1201) on 30 December 1971. Similar galls have been collected 9.7 km (6 miles) southwest of San Vicente, Baja California, Mexico.

Type deposition. — Holotype female and gall in United States National Museum. Paratype insects and galls in United States National Museum (2), California Academy of Science (2), University of California — Davis (2), Weld collection in possession of R. J. Lyon at Los Angeles City College (2) and the authors' collections.

Key to Cynipid Fauna on *Quercus cedrosensis*

1. Cheeks not broadened behind eyes. 2
 Cheeks broadened behind eyes *Callirhytis protobalanus*
2. Ventral spine 3 times as long as high or wide
 *Callirhytis cedros*
 Ventral spine 1.5 times as long as high or wide
 *Callirhytis cedrosensis*

Acknowledgement

The authors are grateful to David Cavagnaro for providing galls which yielded the *Callirhytis cedros* specimens and some paratypes of *Callirhytis cedrosensis*. The gall illustrations were prepared by M. Lynn Siri.

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SCIENTIFIC NOTE

Observations on Spider Predation of Early Instar Larvae of Douglas fir Tussock Moth, *Orgyia pseudotsugata* (McDunnough) (Lepidoptera: Lymantriidae) — In June 1972, studies of Douglas fir tussock moth egg eclosion and larval dispersal in relation to host phenology were conducted near Iron Mountain, El Dorado County, Calif. (Wickman, Boyd E. 1976, Environ. Entomol. 5:316-322.) During the course of this work certain Douglas fir tussock moth egg masses in the lower crown foliage of white fir, *Abies concolor* (Gord. & Glend.) Lindl., were repeatedly visited and observations made to record egg eclosion. During one such visit on June 2 at 0830 PDT, a medium-size spider (about 6-8 mm long) was seen on its web immediately adjacent to an egg mass consuming a 1st-instar larva. The spider repeatedly went from the web onto the egg mass and back to the web. I watched for about 5 min., as the spider darted to the egg mass and extracted another newly emerging larva, evidently paralyzed it with a bite, and deposited it in the web. I waited for the spider to eat the larva, but instead, some minutes later it again pounced on the egg mass and extracted another larva and repeated the action. I continued watching for another 15 min., but the spider did not attack the egg mass again, nor did it feed on its two dead or paralyzed larvae in the web.

I marked the egg mass, intending to visit it during my periodic visits to see if I could determine the effects of spider predation on that particular egg mass. On my next visit at 0900 on June 4, the egg mass was covered with newly hatched larvae, and the spider was never seen again during my visits over the next 2 weeks. In the course of repeated observations of more than 80 separate egg masses during the first 2 weeks of June 1972, similar size spiders and webs were found immediately adjacent to or near 12 egg masses. One additional spider was observed trying to open an unhatched egg. After several minutes it gave up and returned to its web. The spiders were gone at the end of the sampling period and unfortunately were not collected.

Similar observations of egg masses were made in the Blue Mountains of eastern Oregon in 1973. On May 27, at Frizzel Creek, 900m elevation, on 2 separate occasions medium-size spiders (5-8 mm) were seen opening Douglas fir tussock moth eggs on Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), and eating the fully formed larvae which were ready to emerge. In both cases the egg masses were surrounded by webs.

I do not know the total effect of predation by these spiders, but such losses obviously occur during egg eclosion and to early instar larvae. This type of mortality is difficult to measure but may be an important source of population reduction, especially during the several-day interval between eclosion and the time larvae disperse to new foliage for food. During this predispersal period many larvae remain congregated on egg masses and are thus concentrated and more vulnerable to this type of predation. The magnitude of early larval mortality by spider predation is unknown but probably constant; it should be included in life table studies and ultimately in population models of Douglas fir tussock moths. — BOYD WICKMAN, Pacific Northwest Forest and Range Experiment Station, USDA Forest Service, Corvallis, Oregon.

Nests of *Anthocopa enceliae* (Cockerell) and *A. elongata* (Michener)

(Hymenoptera: Megachilidae)

Frank D. Parker

Bee Biology and Systematics Laboratory, ARS, USDA, Utah State University, Logan 84322

Nests of *Anthocopa* (an osmiine megachilid) are relatively unknown although Parker (1975) described those of three species. Nests of two species were associated with trap stems, and the nests of one species were located on the undersurface of stones. In additional trap-stem studies conducted in 1974, nests were found of another species in the subgenus *Eremosmia*, and nests of a species in the subgenus *Atoposmia* were found in cracks between stones. Nests, nesting sites, and nest associates of these two species are described, and additional information is presented concerning the previously described nests of *Anthocopa*.

Anthocopa (*Eremosmia*) *enceliae* (Cockerell) (Figs. A, B)

Nesting Site. Seven nests were recovered from prebored elderberry trap stems (Parker and Bohart, 1966). Five were placed in end holes with a bore diameter of 6mm, and two were made in side holes with diameters of 2 and 4mm, respectively. The five nests in end holes contained 45 cells (from five to fourteen cells/nest) and the two in side holes contained three cells (one to two cells/nest). All the nests were from a single site in White Water Canyon, Riverside Co., California, in trap stems I had placed along the side of the canyon among scattered plants of *Encelia* about 50m above the stream bed.

Nest Construction. The prebored burrows were not modified by the bees except that loose pith was removed. They made most of their cells by partitioning across the burrow at intervals ranging between 6 and 10 mm (Fig. A), but in two nests, partitions were placed longitudinally and medially in the boring, thus resulting in the presence of a cell on either side of the partition. The longitudinal partitions were found at the beginning or the end of a cell series. Partitions were made of a sand-masticated leaf pulp mixture spread into a thin (0.5mm) disc. Often the partitions were made obliquely across the burrow, and there was a rimmed and distinct entrance hole through the partition (some osmiine construct the "ceiling" partition prior to cell provisioning and leave a small entrance hole at one side of this partition). The outersurface of the partition was smooth, and the inner was rough. Because the partitions were set at different angles across the burrow, the measurement of the cells varied considerably. The range in cell length was 6-11mm, and the range in width was 2-6mm. The entrance to some burrows was blocked with a compact plug (5-6mm thick) of sand-masticated leaf pulp mixture set into the burrow 5-6mm below the outer surface. The entrance plugs were

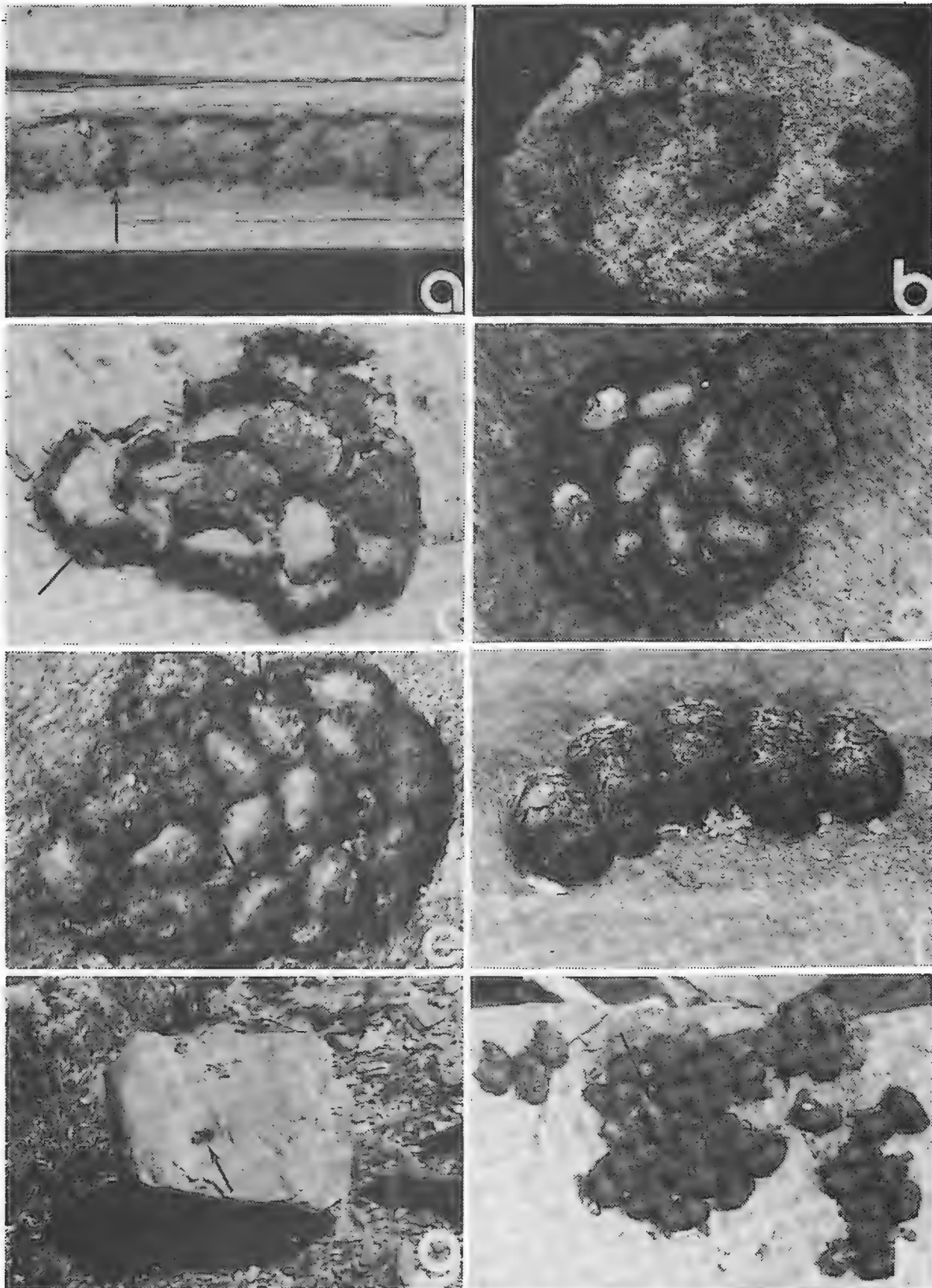


Fig. A. Portion of nest of *A. encelliae* in prebored elderberry trap stem. Dark lines across burrow are cell partitions (arrow). Fig. B. Cocoon of *A. encelliae* removed from cell. Note fecal material and pollen incorporated into cocoon. Fig. C. Seven-celled nest of *A. elongata* containing pollen balls. Arrow indicates wall of new cell. Fig. D. Twelve-celled nest of *A. elongata*. Note fecal pellets against walls of middle cell. Opaque cocoons contain live larvae (arrow). Fig. E. Fifteen-celled nest of *A. elongata* parasitized by *Stelis*. Cocoons of *Stelis* do not fill the cell and are nipped at one end (arrows). Fig. F. Cells of *A. abjecta* attached to underside of rock. Note how dried leaf material is held together by cocoon silk. Fig. G. Four-celled nest of *A. abjecta* on overturned rock (arrow), Willard Pk., Utah. Fig. H. Old nest of *A. abjecta* near margin of overturned stone. Note empty cocoons of *Stelis* (arrow).

H-shaped in a vertical section. The cells made in the side holes were plugged with similar material but were flush with the outer surface of the stem.

Provisions. The cells were "packed" nearly full with pollen from a composite, probably *Encelia*. The pollen mass took the shape of the cells, and it fell apart readily when probed. Because of the crumbly nature of the provisions, egg placement was difficult to ascertain, but it was at the top of the pollen mass. Most cells had a small space between the entrance hole in the partition and the pollen.

Feces. The fecal pellets were amber colored, barely less than 1mm long, slightly bowed, with one end blunt and the other pointed. They were scattered around the sides of the cell and combined into the cocoon strands.

Cocoons. The bees made their distinctive cocoons by closely lining the cell walls with abundant strands of compact whitish silk. Unconsumed pollen and fecal pellets were incorporated into this thick matlike outer layer. The outer layer was asymmetrical and conformed to the cell walls (Fig. B). Also its thickness was unusual: the outer layer of one cocoon was 5X heavier (26mg) than the inner sheath (5.4mg). This outer layer often filled most of the available cell space. A layer of thin varnishlike material was applied on the inside of the outer layer of silk. Longitudinal strands of fecal material were smeared on the inside of the varnished layer. The larvae formed the inner cocoon by thinly coating the fecal material with light brown silk. The strands were more evident in the upper half though the inside of this layer was smooth and shiny. The inner cocoon was barrel-shaped and averaged 6x4mm; the top had a flat or slightly raised area (nipple) distinct from the surrounding surface.

Overwintering. Diapause is passed as bowed, yellowish white prepupal larvae. Prepupae incubated at 72°F produced males in 57-59 days and females in 58-62 days.

Sex Ratio. Only two males and three females emerged.

Nest Associates and Mortality. The common chalcid parasite, *Leucospis affinis* Say, was reared from six cells. Dead eggs or young larvae were recorded in 27% of the cells, and 40% of the cocoons contained dead larvae after incubation.

Discussion. Nests of *A. enceliae* differ from those of the other known species in the subgenus *Eremosmia*, *A. hypostomalis* Michener, in that *A. enceliae* partitions the burrows and cells and *hypostomalis* makes individual cells composed entirely of masticated leaf pulp and sand. Cocoons of the two species differ in that those of *enceliae* are the shape of the cell and the nipple does not protrude. Cocoons of *hypostomalis* are barrel-shaped with a prominent nipple. Similarities exist in the nests of these two species since both are constructed of a mixture of sand and masticated plant parts. Similarities also exist between cells of *A. enceliae* and cells of species of

Osmia. For example, the thick whitish outer layer of the cocoon of *A. enceliae* is similar to that spun by *Osmia texana* Cresson; also the habit of filling the cell with pollen is found in *Osmia*, notably *O. californica* Cresson.

Nests of *A. enceliae* were obtained at the locality where I had placed trap stems two previous years. However, in 1974, I placed some stems along the side of the canyon and in the stream bed. Nests of this *Anthocopa* were recovered only from stems on sides of the canyon; nests of *A. hypostomalis* were recovered from both locations.

Anthocopa (Eremosmia) hypostomalis Michener

Nests and nest associates of *A. hypostomalis* were described previously (Parker, 1975). An additional 61 nests were obtained from trap nests, all but one made in the end hole. The nests contained 260 cells (an average of 4.4 cells/nest with a range of 1-13). In 1974, at the White Water Canyon 45% of the end holes in the trap stems contained this species. Other locations where nests of *A. hypostomalis* were recovered were: CALIFORNIA: 15 mi. N Johannesburg, 24 mi. E Keeler, Yucca Valley, Morongo Valley, 11 mi. NE Bishop, 3 mi. N Bishop, 7 mi. S Palm Springs. UTAH: Hurricane. ARIZONA: 3 mi. S Oatman.

The same species of nest associates reported earlier were found in the new nests. A new association was demonstrated by three cells containing adults of the meloid *Nemognatha*.

Anthocopa (Atoposmia) elongata Michener
(Figs. C, D, E)

Nesting Site. All nests of *A. elongata* were associated with rock outcroppings and were constructed in cracks between stones. Nests were found at several places in the mountains surrounding Logan, Utah. At Willard Peak, Box Elder Co., the nests were located between broken layers of shale along the trail leading to the summit (9700 ft). In Logan Canyon, nests were located in rocky ledges at Blind Hollow, near the Franklin Basin turnoff, and along Beaver Creek.

Nest Construction. All nests were found in cracks 2-3mm wide; both vertical and horizontal cracks contained nests. Many old nests were found relatively undisturbed except for the exit holes of the bees and parasites. The 20 nests found averaged 11.4 cells/nest with a range of 3-23 cells/nest. No nests during the early stage of construction were found, and data on formation can only be surmised. Since most nests were oval, the initial cell is probably central, and additional cells are attached to it in a circular pattern (Fig. C). The bees began their cells by making a thin U-shaped corral-like wall from masticated plant parts and fine sand. They made additional cells by attaching another wall to the first or to other cells, thereby utilizing an existing surface as one side of the cell (Fig. C, arrow). Cell walls at

the outer rim of the nests were as thick as 2mm. Cells were 5-6mm long and 3-4mm wide, and there was no discernable pattern in cell orientation as some cells faced outward and some faced toward the center of the nest (Fig. D).

Provisions. The provisions were shaped into an oval ball (Fig. C) that contained loose pollen grains on the outside. Enough nectar was added to bring the pollen mass to a gum-like consistency. Stereoscan micrographs of pollen made from several nests were identified by P. Lincoln (UC-Santa Cruz) as *Penstemon*. Moldenke and Neff (1974) reported that *A. elongata* was an oligolege of *Penstemon*. The host egg was deposited at the top and to one side of the mass.

Feces. Many pellets were found at the top of the cell where they had been deposited before cocoon formation (Fig. D). Other pellets were scattered along the sides of the cell. The pellets were yellowish-white, 0.5-0.6mm, 0.1-0.2mm wide, slightly bowed, pointed at the ends, and with an impressed longitudinal line. Other pellets were flattened against the walls during cocoon spinning.

Cocoon. The cell walls were closely lined with a thin amber-colored, translucent layer of silk. The top of the cocoon was composed of coarse, loose silk strands that filled the space under the cell cap. Below this silk, the top of the cocoon was loosely spun and (in most specimens) a small opening was left. The inner surface of the cocoon was shiny with the strands forming this layer distinct. The larvae inside were easy to see through the cocoon (Fig. D).

Overwintering. The overwintering stage was a prepupal larva. The incubated larvae required 57-58 days at 72° F to become adults. They were C-shaped, white, and very active when probed.

Sex Ratio. Sixteen females and eight males emerged.

Parasites. The most abundant parasite associated with *A. elongata* was an undescribed species of *Stelis* (*Chelynia*) (Fig. E). This small black parasite is one of the smallest (4mm) species that I have seen in the subgenus *Chelynia*. Fourteen percent of the cells in both old and active nests had been parasitized by *Stelis*. Two cells in one nest were parasitized by the common bombyliid, *Anthrax irroratus* Say. Another common bee parasite reared from this host was *Tetrastichus megachilidis* Burks, which was found in nine cells in active nests. Many bee larvae in old nests also had been parasitized by *Tetrastichus*.

Discussion. *A. elongata* cells differ from those of the other known species in the subgenus *Atoposmia* in that *elongata* builds cell partitions and does not line all surfaces with cell-building material; *A. abjecta* makes separate cells and lines the entire cell with nest-building material (Fig. F). The cocoons of both species are similar, especially the loosely spun and coarse silk at the top. Cells of *A. (Hexosmia) copelandica* (Cockerell) are similar to those of *A. elongata*

in that the cell walls are closely lined and the cocoon takes the shape of the cell; the fecal pellets are of similar size and shape, and the material used to build cell partitions is mostly masticated plant parts.

Anthocopa (*Atoposmia*) *abjecta* (Cresson)
(Figs. F, G, H)

Nests of *A. abjecta* were described by Parker (1975) and additional nests of *A. abjecta* were located at Willard Pk., Utah, attached to the undersurface of stones (Fig. G). The nine nests found averaged 9.2 cells/nest with a range of 3-38. No live parasites were recovered, but some old nests contained cocoons of *Stelis* (Fig. H).

Anthocopa (*Hexosmia*) *copelandica* (Cockerell)

Nests of *A. copelandica* were described earlier (Parker, 1975). Additional trap-stem studies during the years 1973 and 1974 produced nests from the following locations: ARIZONA: Kingman. UTAH: Logan Canyon, Cache Co. (3 sites); 9 mi W Mendon, Cache Co.; Willard Peak, Box Elder Co. CALIFORNIA: 5 mi. S Kramer Jct., 15 mi. N Johannesburg, 14 mi. N Little Lake. The 109 nests recovered contained 591 cells with a range of 1-18 cells/nest. New nest associates of *A. copelandica* are: the megachilids, *Stelis* (*Chelynia*) *subemarginatam* (Cresson) from eleven cells and *Stelis* (*Microstelis*) *lateralis* Cresson from ten cells; the chrysidid parasite *Chrysura kyrae* Krombein from two cells; the bombyliid *Anthrax irroratus* from seven cells; and the common clerid predator *Trichodes ornatus* Say from ten cells.

Acknowledgments

Thanks are due to C.D. Michener (UK) who reviewed the determinations of the host bees. G. Gordh, Systematic Entomology, ARS, USDA, identified the chalcids, and R. M. Bohart, Univ. of Calif., Davis, made determinations of the chrysidids. Special thanks to those who spent many hours collecting source material and making the trap stems — D. Cheney, H. Potter, and C. Sanders of our bee laboratory; D. Cheney also helped collect many of the nests of *Anthocopa* found under stones. W. P. Nye of our bee laboratory assisted with the photography. Appreciation is extended to those people who reviewed this manuscript — R. R. Snelling (LA County Museum) and G. E. Bohart (USU).

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A new *Culicoides* Biting Midge from California

(Diptera: Ceratopogonidae)

Willis W. Wirth

Systematic Entomology Laboratory, IBIII, Agr. Res. Serv., USDA,
c/o U. S. National Museum, Washington, D. C. 20560

Through the courtesy of Paul H. Arnaud, Jr. of the California Academy of Sciences I received for study a fine collection of biting midges taken by Hugh B. Leech at Howell Mountain, Napa County, California. Most of this collection consisted of a remarkable new species of *Culicoides* of the *palmerae* group that was not found when Wirth and Rowley (1971) revised the group. The new species is closely related to *Culicoides utahensis* Fox, the interesting habits and anatomical modifications of which were discussed in our revision. In *C. utahensis* the male antennae and palpi are not of the normal male type, but closely resemble those of the female, presumably to enable the male to locate the same warm-blooded animal as the female, and there to mate on contact with her. Both sexes of *utahensis* have been found *in copulo* deep inside the base of the ears of jackrabbits, sheep, and deer in California. In the present collection, which was taken at light, a considerable number of individuals of the new species were found *in copulo*; and the males are characterized by the same female-type modifications of the antennae and palpi found in *C. utahensis*. The new species is easily recognized as it is much larger and darker than *utahensis*; and the males differ markedly in some features of their genitalia. I am very pleased to name this species after the collector, Mr. Hugh B. Leech of the California Academy of Sciences, in appreciation of his friendship and his long and continued interest in collecting biting midges throughout western North America.

The reader is referred to the revision of Wirth and Rowley (1971) for a diagnosis and discussion of the *palmerae* group, for explanation of the terminology used, and for a key to species and a table of numerical characters for the separation of closely related species.

Culicoides leechi, new species

(Fig. 1)

Female Allotype. — Wing length 1.61 mm, breadth 0.76 mm.

Head: Eyes (fig. 1d) broadly separated. Antenna (Fig. 1a) with lengths of flagellar segments in proportion of 32-21-22-22-23-23-23-38-41-42-44-57; AR 1.18; sensory pattern 3-15. Palpal segments (Fig. 1f) with lengths in proportion of 15-35-60-22-20; third segment greatly swollen, with large, round, moderately deep, sensory pit; PR 2.2. Proboscis long, P/H ratio 0.90; mandible with 15 teeth.

Thorax: Dark brown without prominent pattern. Legs with femora and tibiae dark brown, tarsi paler; tibial comb with 4 spines, the second from the spur longest. Wing with pattern as figured (Fig. 1c); pattern restricted to two small anterior pale spots, one over m -crossvein and second on anterior wing margin just distad of tip of costa; a dark stigma present formed by the darkened heavier veins forming second radial cell and distal half of first; CR 0.59; macrotrichia numerous over entire wing, rather long and spinelike. Halter moderately infuscated.

Abdomen: Brown. Spermathecae (Fig. 1h) two plus an elongate rudimentary third, sclerotized ring absent; functional spermathecae subequal in size, each measuring 0.067 by 0.045 mm, ovoid with slightly oblique, short, tapering necks.

Male Holotype. — Wing length 1.47 mm, breadth 0.69 mm. Eyes (Fig. 1e) narrowly separated; mandibular teeth vestigial. Antenna (Fig. 1b) similar to that of female, lengths of flagellar segments in proportion of 35-21-21-22-22-23-24-25-36-36-40-42-60; PR 1.7. Wing pattern as in female; CR 0.59. Genitalia (Fig. 1j): Ninth sternum with very shallow caudo-median excavation, the ventral membrane not spiculate; ninth tergum elongate and tapering distad, with prominent elongate apicolateral processes much stouter and more flaring than in *C. utahensis*, the caudal margin between them slightly convex with slight mesal notch. Basistyle moderately stout, ventral and dorsal roots simple, the ventral root short and the dorsal elongate and slender; dististyle evenly curved, not hooked at base, tapering to moderately slender, blunt tip. Aedeagus short and stout with broad base,

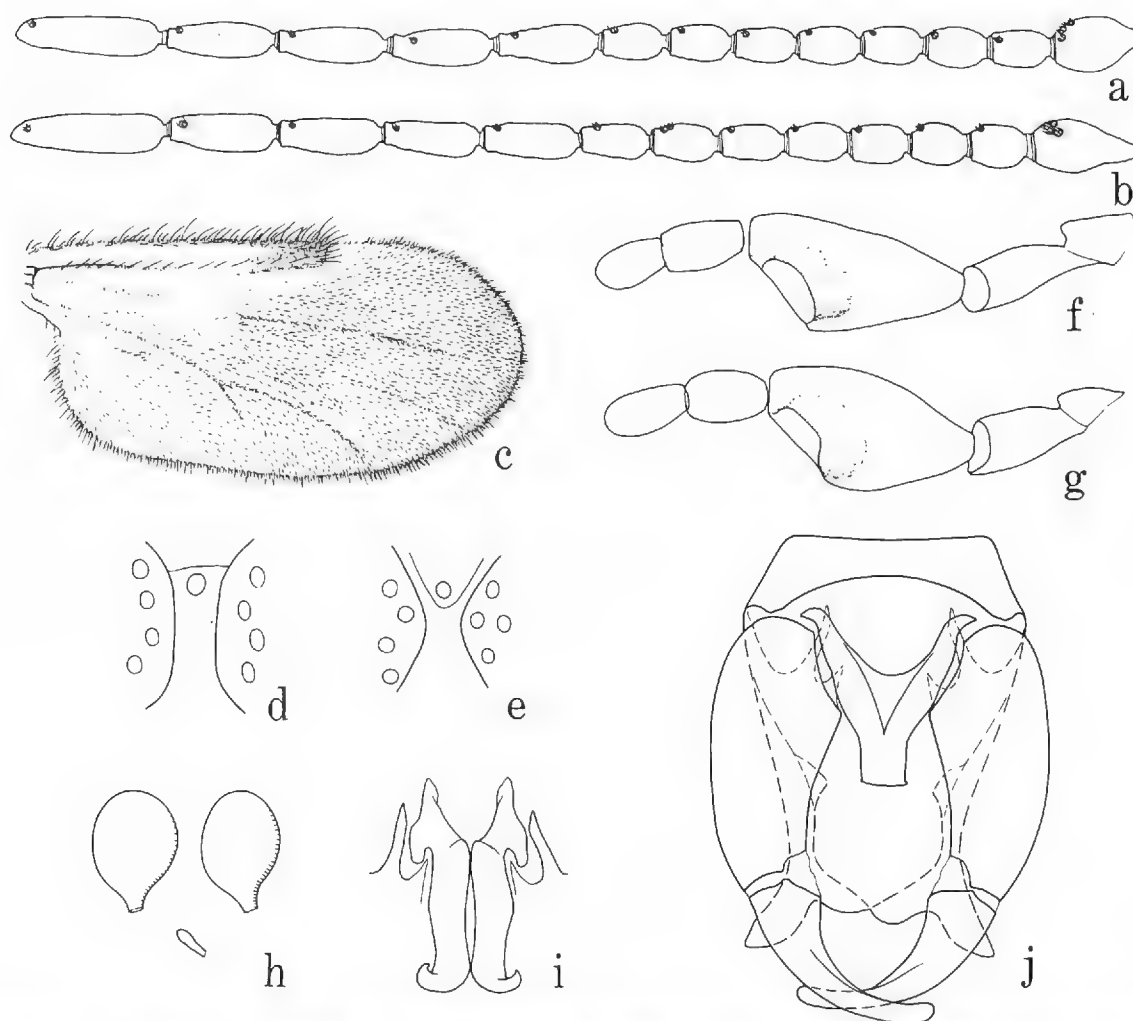


Fig. 1. *Culicoides leechi* n. sp. a,c,d,f,h, female; b,e,g,i,j, male; a,b, antenna; c, wing; d,e, eye separation; f,g, palpus; h, spermathecae; i, parameres; j, genitalia, parameres removed.

basal arch extending to 0.4 of total length, apex broad and truncate, not quite as broad and flaring as in *C. utahensis*. Parameres (Fig. 1i) each with prominent basal process delimited by a sub-basal constriction, stem stout and slightly tapering distally, abruptly bent ventrolaterad distally with a simple pointed tip that is stouter than in *C. utahensis*.

Distribution. — California.

Types. — Holotype male, allotype female, Napa County, California, north side of Howell Mountain 2 miles NNE of Angwin, 1300 feet, 17 May 1975, H. B. Leech, at light (Type no. 12640, Calif. Acad. Sci.). Paratypes, 39 males, 22 females, and 8 pairs *in copulo*, same data (in Calif. Acad. Sci. and USNM); 1 male, Pozo, San Luis Obispo Co., California, 27 April 1962, P. D. Hurd, light trap (USNM).

Taken in the same collection with *Culicoides leechi* n. sp. were the following *Culicoides* species: *C. utahensis* Fox, 5 males, 1 female; *C. oregonensis* Wirth and Rowley, 4 males, 3 females (also in the *C. palmerae* group); *C. neomontanus* Wirth, 12 females; *C. neofagineus* Wirth and Blanton, 1 female; and *C. lahontan* Wirth and Blanton, 1 female. Dr. Arnaud also sent me 1 female of *C. neofagineus* taken by Mr. Leech at Howell Mountain 9 June 1975, with note "bit my arm, late evening after dark; bite did not itch for long."

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- Wirth, W. W., and W. A. Rowley 1971. A revision of the *palmerae* group of the genus *Culicoides*. Kansas Entomol. Soc. 44:153-171.

RECENT LITERATURE

Geographic Variability in *Speyeria*: Comments, Records and Description of a New Subspecies (Nymphalidae). A. H. Moeck. 48 pp. 1957. (Reprinted by Entomological Reprint Specialists, P.O. Box 77224, Dockweiler Station, Los Angeles, California 90007). \$3.50.

As one who had the treasured experience of sitting in the old country house enjoying the warm hospitality of L. Paul Grey, Lincoln, Maine and listening to his ruminations about *Speyeria* variability, I was delighted to read a study the stimulus for which was in large part provided by Mr. Grey in the same setting. Mr. Moeck described one subspecies, *zerene gloriosa*, and discussed *idalia*, *edwardsii*, *cybele*, *aphrodite*, *coronis*, *zerene*, *callippe*, *egelis*, *atlantis*, and *hydaspe*. This reprinted work is still a very useful guide to a tough complex of North American fritillary butterflies. — TDE.

Population Genetics and Ecology (Proceedings of the Conference held in Israel, March 1975). Edited by S. Karlin and E. Nevo. Academic Press, New York, San Francisco, London. 1976. 846 pp. \$25.50.

The Insects of Virginia: No. 9. Squash, Broad-headed, and Scentless Plant Bugs of Virginia (Hemiptera: Coreoidea: Coreidae, Alydidae, Rhopalidae). R. L. Hoffman. Virginia Polytechnic Institute and State University Research Division Bulletin 105: 1-52. 1975. Available on exchange basis from the Distribution Center, VPI&SU, Research Division Publications, 111 Landsdowne Street, Blacksburg, Virginia 24060.

This publication covers 27 species of coreoid bugs known from Virginia and treats them from the standpoint of geographic distribution, seasonal occurrence, and host plant preferences. Keys are provided for all included taxa. — TDE.

Description of Two New Species of *Heterosarus* Robertson

(Hymenoptera, Apoidea)

P. H. Timberlake

University of California, Riverside

Since completion of my work on the genus *Heterosarus*, published in 1975, two new species have come to my attention, one from the United States and one from Costa Rica. The species from the United States apparently is uncommon and unfortunately is represented by only one specimen, but nevertheless with very distinctive characters.

Heterosarus dakotensis, new species

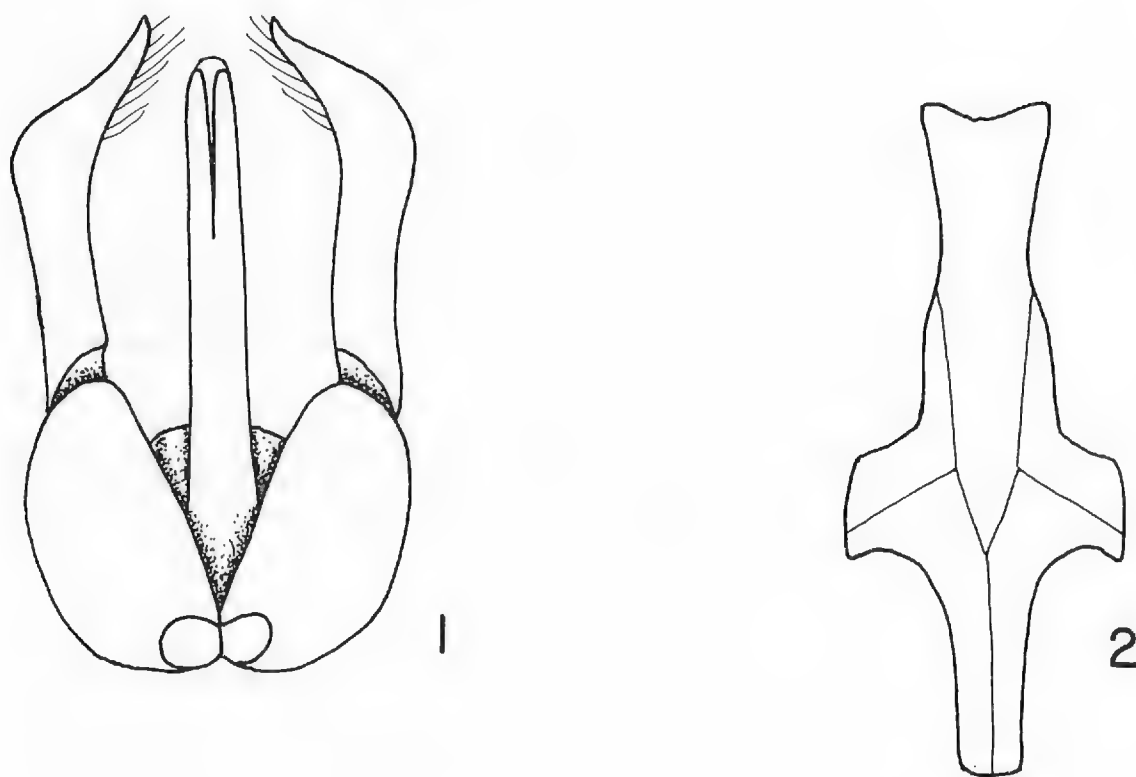
(Figs. 1 and 2)

The male of this species runs to *virginicus* Ckll. in the *Heterosarus* key (1975) and differs in somewhat smaller head, about as broad as long, with inner orbits slightly diverging above (in *virginicus* head slightly broader than long, widest anteriorly, with orbits slightly diverging in front); lateral marks of face larger and ending acutely on orbits about halfway above level of summit of clypeus to level of antennal sockets. Clypeal yellow mark thus about as high as wide, instead of broader than long. Color characters otherwise very similar, but flagellum more uniformly dark, legs nearly all dark, and wings more dusky.

Male — Black, with dark legs and antennae, with anterior sides of front tibiae flavo-testaceous. Base of mandibles, disk of labrum, clypeus and lateral marks yellow. Lateral marks oblique above and ending acutely on orbits nearly halfway above level of summit of clypeus to level of antennal sockets, the black, thus touching upper fourth of side of clypeus. Tubercles dark, slightly tinged with brown. Tegulae dark testaceous. Wings almost uniformly and moderately tinged with dusiness, nervures and stigma fuscous.

Head rotund, as broad as long with inner orbits slightly diverging above; cheeks about as broad as eyes and widest just below level of summit of eyes. Temples about one-third as long as eyes. Occiput broadly and rather deeply concave. Posterior ocelli distinctly behind level of summit of eyes, somewhat more than their distance apart from occipital margin and much more distant from margin of eyes. Facial foveae narrowly wedge shape and close to margin of eyes. Antennae inserted at level of middle of eyes, scape not reaching level of anterior ocellus; flagellum moderately clavate, with middle joints slightly longer than thick. Face below level of antennae evenly and strongly convex. Sides of clypeus oblique and almost straight, with truncate summit about half as wide as anterior margin. Process of labrum twice as broad as long and rounded across apex. Proboscis retracted in type and filling proboscoidal fossa. Pterostigma nearly as long and as wide as first submarginal cell. Second submarginal cell narrowed one-half above and receiving recurrent nervure one-fifth of its length from base.

Head and thorax minutely and densely punctured and rather dull, but face more shining than thorax. Frons, vertex, cheeks and mesonotum similarly punctured, but punctures of yellow part of face less distinct, but dense, and mesopleura and propodeum impunctate and mat, but sternum obscurely punctured. Basal enclosure of propodeum narrow and finely rugose. Head and thorax nearly bare, with very short, thin hair visible on occiput and short, thin, whitish pubescence on mesosternum. Abdomen dull, impunctate, with base of tergites 2 and 3 narrowly impressed and slightly brownish apical depression about as broad as disk. Apical sternite with median emargination. Subgenital



Figs. 1-2. *Heterosarus dakotensis*, genital armature and subgenital plate.

plate strongly curved as usual, with apical plate more than twice as long as wide, widest on basal half, then constricted before emarginate apex, and devoid of fimbria; lateral apodemes very short and broadly truncate. Parameral lobes of genital armature strongly bent inward on apical part, dilated at bend, subacute apically, with apical fimbria on ventral inner margin directed inwardly. Sagittae fused, uniformly very slender and somewhat shorter than the parameral lobes.

Length, 5mm.; anterior wing, 3.75mm.; width of abdomen, 1mm.

Holotype male, Tokio, North Dakota, July 28, 1937 (C. L. Johnston).

Type in the collection of the University of Kansas, Lawrence.

***Heterosarus setiger*, new species**

(Figs. 3 and 4)

This new species from Costa Rica falls in the key next to *aristatus* and *bakeri*, and differs from *aristatus* in the duller, more obscurely punctured mesopleura, and from *bakeri* and, in fact, other species of the group, in the long, bristling black hairs of the face and mesonotum. The male differs from *bakeri* in the dull thorax, with very dense punctures on the mesoscutum, as well as in the long, erect dark hair.

Female — Black, with face and thorax entirely dark. Legs and antennae dark, tibial spurs testaceous, apex of claws ferruginous. Tegulae piceous. Wings subfuliginous, nervures and stigma dark.

Head as long as wide, inner orbits of eyes slightly diverging above; cheeks broad behind and narrowed to vanishing point anteriorly and nearly as wide as eyes. Posterior ocelli somewhat more removed from occipital margin than distance between their outer margin and about one-third more distant from eyes. Facial foveae small and obscured by sculpture. Antennae normal, flagellum slightly clavate, with middle joints as long as

thick, and joint 1 nearly as long as next two together. Clypeus broader than long, rounded above, with outer ends strongly inflexed. Process of labrum as long as wide at base, sides converging to rounded apex and disk smooth and shining. Proboscis normal, galeae reaching halfway to base of stipites. Venation normal. Spur of middle tibiae with about seven small, sharp teeth, decreasing in size basad. Abdomen oval, convex above, somewhat more than twice as long as wide.

Head and thorax dull, densely punctured. Frons, vertex and cheeks finely and subrugosely punctured; sculpture below level of antennae much coarser, with punctures slightly separated and still coarser and more separated on clypeus. Mesonotum very finely and densely punctured, with scattered larger setiferous punctures. Mesopleura dull, with large, shallow punctures, rather obscure in comparison with those of *aristatus*. Propodeum, including basal area, very finely and densely rugose. Abdomen shining, mostly impunctate, but with very minute punctures across basal part of disk on tergites 2 and 3; base of segments very weakly impressed, minutely lineolate, with impression about half as wide as disk; apical depressions very broad, reaching about halfway to base on tergites 2 to 4, and faintly tessellate. Pubescence of cheeks and sides of thorax including propodeum whitish and finely plumose, but face and mesonotum with long bristling black hair, that on face including upper border of clypeus, scape of antennae and occipital fringe. Mesonotum otherwise appearing bare, but with extremely short and fine pale pubescence. Hind margin of collar of pronotum with pale tomentum, better developed on margin of tubercles. Metanotum with similar pubescence. Abdomen bare above except thinly hairy on lateral margins toward apex, with apical fimbria thin, moderately long and partly black. Hair of venter long and erect across apical part of segments. Hair of legs pale, except black on outer margin of hind tibiae, with scopal hair moderately dense, semi-erect, inclined toward apex of tibia and at most only slightly longer than width of tibia.

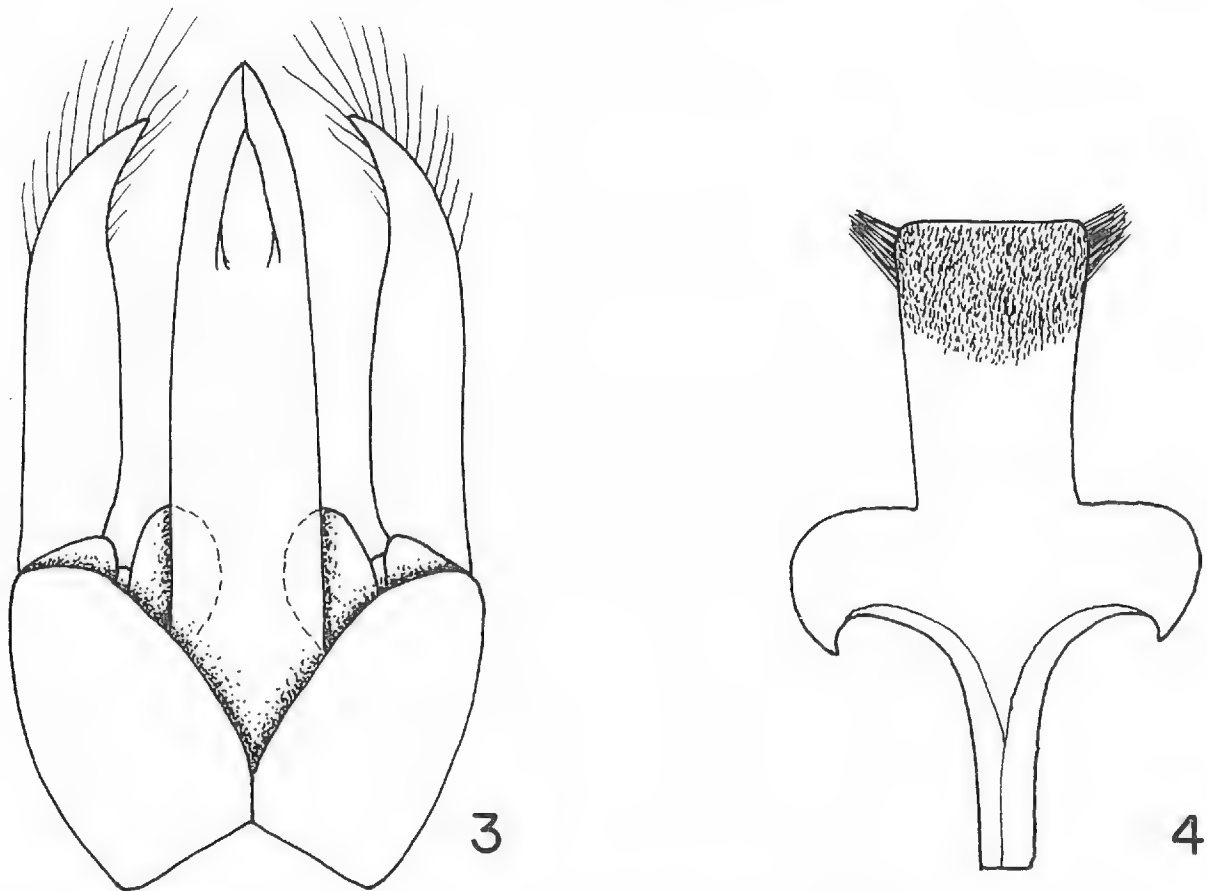
Length, about 7mm.; anterior wing, 5.3mm.; width of abdomen, 1.8mm.

Male — Head, thorax and abdomen black, except for pale yellow clypeal mark. Mark slightly broader than long, leaving anterior and lateral margins of clypeus narrowly dark and outer ends broadly dark. Coloration otherwise as in female.

Head as broad as long, with inner orbits of eyes strongly diverging above; cheeks broad above, about four-fifths as wide as eyes. Posterior ocelli slightly less than twice their diameter apart and about same distance from eye and occipital margin as in female. Antennae inserted near middle of face and above level of middle of eyes; antennal sockets closer to margin of eyes than to each other; flagellum thickly cylindrical, with middle joints barely longer than thick. Clypeus about as broad as high, very strongly and broadly inflexed on each side. Process of labrum slightly broader at base than long, sides moderately converging to truncate apex, disk smooth and shining. Proboscis normal in length, galeae reaching less than halfway to base of stipites in repose and exceeded by apical joint of maxillary palpi and by last two joints of labial palpi; galeae very minutely and densely tessellate-punctate and dull.

Head and thorax dull, densely and very finely punctured. Face below level of antennae more shining than frons, with comparatively coarse punctures, those in parocular areas mostly longer than wide and those on clypeus shallow and well separated. Upper part of mesopleura, metapleura and flanks of propodeum very minutely abutaceous and mat, with part of mesopleura toward sternum more shining and with rather obscure shallow punctures.

Abdomen shining, rather sparsely and very minutely punctured across disk of tergites 2 to 4, with apical depressions extremely broad and weakly tessellate. Pubescence much as in female, but short, fine, pale pubescence of mesonotum more evident, and metanotum with short, erect pubescence. Abdomen nearly bare, but with short, pale hair on lateral margins, venter with few appressed hairs across apical border of fourth segment and thin patch of fine hair directed inward on each side of fifth segment. Sternite 6 with shallow emargination of apex. Subgenital plate (sternite 8) with apical plate about twice as long as wide, and distinctly widened toward truncate apex. Genital armature simple with parameral lobes and gonocoxites fused and tapering from base to incurved apex;



Figs. 3-4. *Heterosarus setiger*, genital armature and subgenital plate.

sagittae fused, acute at apex, and reaching somewhat beyond apex of parameral lobes.

Length, 5.5mm.; anterior wing, 4.7mm.; width of abdomen, 1.3mm.

Holotype female, Cerro de la Muerte, 6 km. west of Villa Millo, on Inter-American Highway, San Jose Province, Costa Rica, on *Senecio benestedianus* Beck, January 25, 1972, and allotype, same place and flower, February 23, 1972 (E. R. Heithaus).

Paratypes — San Jose Province, 22 females, 4 males, collected with types January 2 to February 25, 1972, and 1 female on same flower, June 3 (Heithaus). Castago Province, 7 females, 1 male, 18 miles north of Castago, February 3, 1965 (D. H. Janzen). Alajuela Province, 1 female, 2 miles west of Palmares, January 23, 1965 (Janzen). Irazu, 11,000 ft., 1 female, October, 1953 (N. L. H. Krauss). Imperfect specimens taken 4 km. east of San Ignacio de Acosta, 4,000 ft., San Jose Province, July 8, 1963 (C. D. Michener and party).

Types in collection of the California Academy of Sciences, San Francisco; paratypes in collection of the University of California, Riverside, University of Kansas, Lawrence, and in collection of E. R. Heithaus.

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- Timberlake, P.H. 1975. The North American Species of *Heterosarus* Robertson. University of California, Publication in Entomology, 77: 1-56, figs. 1-87.

Two New Species of *Acanthoscelides* from North America and New Host Records from *Desmanthus* and *Hoffmanseggia*

(Coleoptera: Bruchidae)

Clarence Dan Johnson

Department of Biological Sciences, Northern Arizona University, Flagstaff 86011

In recent years considerable interest has been shown in the systematics, ecology, behavior, host plants, and evolution of non-economic species of Bruchidae. For example, Janzen (1969, 1971a, 1971b, 1975, 1976), Center and Johnson (1973, 1974, 1976), Whitehead and Kingsolver (1975a, 1975b), Pfaffenberger and Johnson (1976), and Johnson and Kingsolver (1973, 1976) represent some of the research that has been published on these aspects of the Bruchidae. Because names for new species are needed for research in progress on the Bruchidae, two new *Acanthoscelides* are described here and their known host plants are given.

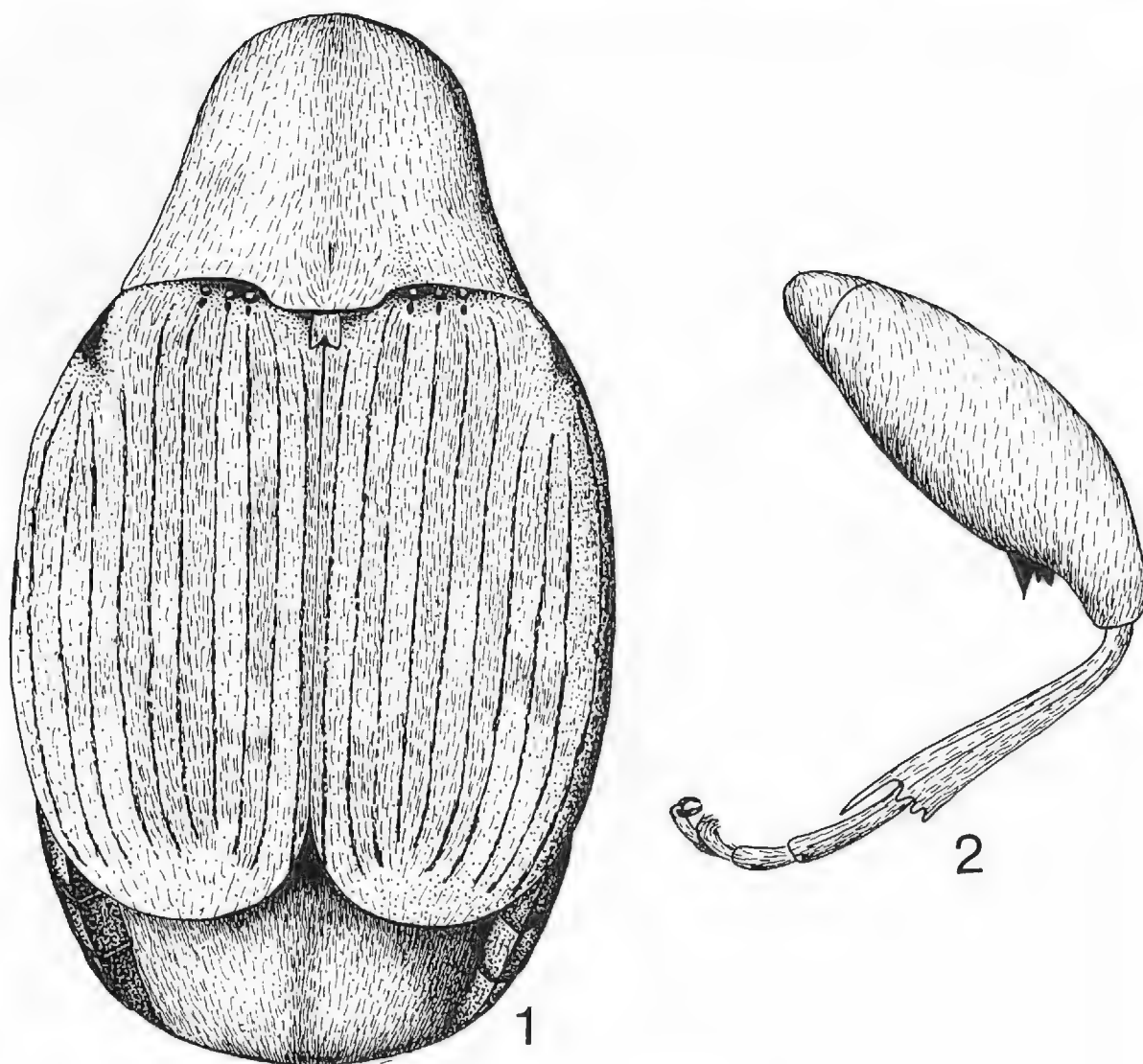
Since Johnson and Kingsolver's 1976 treatment of *Stator* was completed and especially since Johnson's 1970 revision of *Acanthoscelides* was published, much new host data have become available. These data are given here to supplement host data given in the above works and host locality data are published as a reference for ongoing research. For ease of reference the host information is cross-referenced in two tables.

The methods of Johnson (1970) for collecting and rearing were used. In this paper C. D. Johnson is abbreviated CDJ and L. J. Bottimer is abbreviated LJB.

Acknowledgments

Field assistance was provided by Margaret and Cheryl Johnson while Roland Medina and Joel Floyd provided consistent and diligent help in the laboratory. Floyd also drew the figures of the habitus, heads and hind legs. For this I am very grateful.

For the generous loan of specimens for this study I would like to express my gratitude to P. D. Ashlock, The University of Kansas; D. E. Bright and E. C. Becker, Canadian National Collection of Insects, Ottawa; H. R. Burke, Texas A & M University, College Station; J. F. Lawrence, Museum of Comparative Zoology, Harvard University, Cambridge, Mass.; H. B. Leech, California Academy of Sciences, San Francisco; and S. Frommer, University of California, Riverside. In addition, Bright and Becker made available the host records of Bottimer. I also thank John Kingsolver for critical reading of the manuscript, and R. Liesner and T. Croat, Missouri Botanical Garden, J. L. Strother, University of California, Berkeley, and D. Verity, University of California, Los Angeles for plant determinations.



Figs. 1-2, *Acanthoscelides derifieldi*: 1. habitus; 2. hind leg.

Partial financial support for this research was provided by the Entomology Research Division (now Insect Identification and Beneficial Insect Introduction Institute), U. S. Department of Agriculture, under Grants 12-14-100-9187(33) and 12-14-100-9970(33).

***Acanthoscelides derifieldi*, new species**

(Figs. 1-4)

Length (pronotum-elytra) 1.5-2.3mm. Width 1.0-1.5mm. Maximum thoracic depth 0.8-1.2mm.

MALE: Integument Color — Head black; basal four to five antennal segments red orange, remainder dark brown to black. Prothorax, elytra, pygidium and undersurfaces dark brown to black. Pro- and mesothoracic legs red orange except about basal 0.1 of femora dark brown; metathoracic legs red orange except basal 0.5 of femur dark brown to black. **Vestiture** — With recumbent white, golden and brown hairs as follows: eye with medial fringe of white hairs; postocular lobe with short white hairs; dense postocular patch of white hairs; remainder of head with white hairs, hairs becoming brownish at base of head; pronotum with brown hairs interrupted by a narrow white stripe on midline, a small white

patch on either side lateral to stripe, and basal white patches (fig. 1); undersurface of prothorax with white hairs; pattern of elytral vestiture variable with patches of brown and white hairs, sometimes brown predominating, sometimes white; basic pattern of elytron is usually irregular bands of brown hairs near base, middle, and apex (fig. 1); pygidium with moderately dense white hairs, becoming more dense at base near middle, usually forming a line of dense white hairs on midline; line flanked on either side by two irregular patches of brown hairs; undersurfaces and legs covered with uniform, moderately dense to dense white hairs. *Head* — Short, densely punctulate; frons without line or carina extending from frontoclypeal suture to vertex; vague transverse sulcus between upper limits of eyes; width of eye about equal to width of frons; ocular sinus about 0.66 as long as width of eye; posterior margin of eye protruding from adjacent surfaces; postocular lobe rounded, not angulate; distance from base of antennae to apex of labrum about 0.5 as long as distance from upper limits of eyes to apex of labrum; antennal segments 1 and 3 usually filiform, 2 and 4 usually moniliform; 5 to 10 eccentric, 11th subacute apically; 5 to 11 slightly broader than long; antenna reaching to slightly beyond humerus. *Prothorax* — Disk subcampanulate (fig. 1), with many punctations; cervical sulcus well-marked, extending from near coxal cavity to about 0.5 distance to pronotal midline; lateral prothoracic carina vague, present only near base; short median impressed line on median basal lobe usually obscured by pubescence; prosternum separating procoxae for about 0.7 their length. *Mesothorax and Metathorax* — Scutellum small, slightly longer than broad, with lateral posterior teeth, clothed with dense recumbent white hairs; elytron about twice as long as broad; striae deep, punctate, strial intervals rugulose; distance between striae at base subequal (fig. 1), often 5 and 6 closer to one another at base than to adjacent striae; small pits preceded by a small spine at bases of striae 3,4,5; humerus rugulose, usually glabrous; undersurfaces punctate; all of hind coxa punctate; hind femur constricted basally and apically, expanded medially to 1.3 to 1.5 times more than width of coxa (fig. 2); inner ventral surface with vague longitudinal carina; femur armed with an inner subapical acuminate spine about 1.2 as long as width of tibial base, and 2 or 3 smaller spines 0.33 to 0.5 as long as 1st spine; tibia with ventral, lateroventral, lateral and dorsomesal glabrous longitudinal carinae; dorsal surface without fossa; tibial corona with 3 to 4 spinules, mucro about 0.45 as long as 1st tarsomere; sinus at base of mucro; 1st tarsomere with ventral, lateral and mesal glabrous longitudinal carinae. *Abdomen* — Sterna not flattened medially; 1st sternum with small tuft of dense white hairs on midline near base, sternum about 0.33 as long as abdomen, posterior margin straight; sterna 2 to 4 unmodified, 5th emarginate; pygidium punctulate, convex in lateral view. *Genitalia* — Figs. 3, 4. Median lobe elongate; in ventral view ventral valve subtriangular, lateral margins arcuate, base about 0.75 as wide as apex of median lobe, with a sharp ridge along midline, arcuate in lateral view; without hinge sclerites; armature of internal sac consisting of 3 large, rounded spines, one slender spine, and 2, paired, elongate spines near middle; dense mass of spicules near apex, sometimes spicules associated with dense, slender, sclerotized rods. Lateral lobes slender, elongate, expanded apically, cleft to about 0.8 their length (fig. 4).

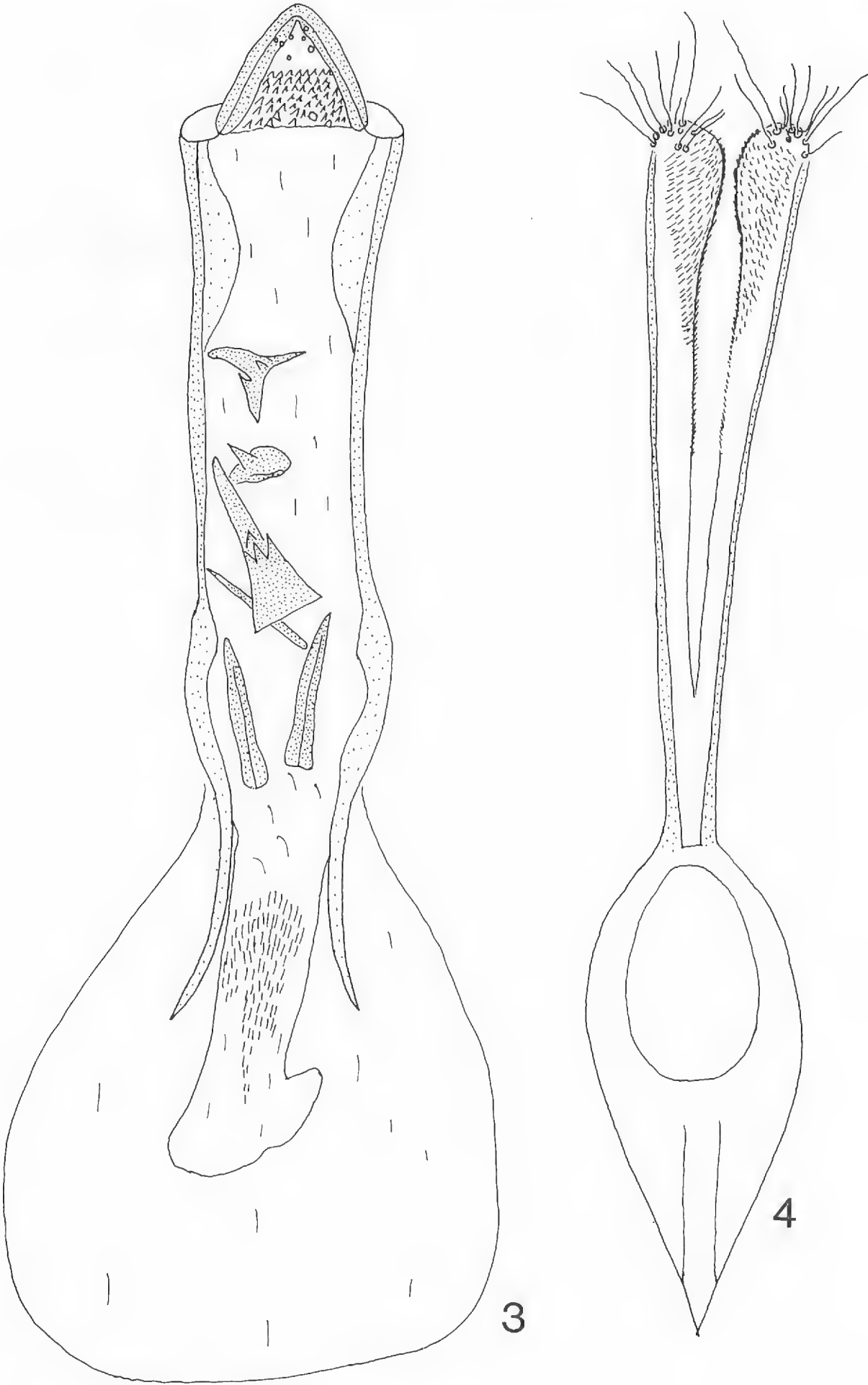
FEMALE: Similar to male except antenna shorter reaching only to humerus; apex of last abdominal sternum convex, about as long as 2 preceding sterna.

HOST PLANTS: *Desmanthus* spp.: Mexico. Sonora: Benjamin Hill, 21 December 1972 (CDJ #134-72) and 31 December 1975 (CDJ #159-75); 8 mi N El Oasis, 31 August 1965 (CDJ); 15 mi S Oroz, 28 January 1964 (P. M. Estes).

Desmanthus covillei (Britt. & Rose) Wiggins ex Turner: Mexico. Sonora: 8 mi E Navojoa, 24 February 1973 (CDJ #175-73); 9 mi E Navojoa, 30 December 1975 (CDJ #152-75).

D. subulatus (Britton & Rose) Wiggins ex Turner: Mexico. Baja California Sur: 9 mi S Villa Constitucion, 25 December 1975 (CDJ #103-75).

TYPE SERIES: Holotype ♂ allotype ♀ and several paratypes: Mexico. Sonora: 9 mi E Navojoa, 30 December 1975, reared seeds *Desmanthus covillei*, C. D. Johnson collector, #152-75. USNM #72783. Additional paratypes listed under HOST PLANTS. Other specimen (not a paratype): Mexico. Sonora: 42 mi N Guaymas, 30 August 1965 (C. D. Johnson). Holotype, allotype and several paratypes deposited in the U. S. National Museum of Natural



Figs. 3-4, *Acanthoscelides derifieldi* male genitalia: 3. median lobe; 4. lateral lobes.

History, Washington, D.C. Paratypes retained in the author's collection and also deposited in the following collections: Arizona State University, Tempe; California Academy of Sciences, San Francisco; Canadian National Collection of Insects, Ottawa; Museum of Comparative Zoology, Harvard University, Cambridge, Mass.; and the University of Arizona, Tucson.

Acanthoscelides derifieldi is a rare species which superficially resembles *A. pullus* (Fall) and *A. pauperculus* (LeConte) in the color pattern of the dorsal surfaces. It differs from *A. pullus* in having a longer tibial spine, a wider, stronger hind femur, and a shorter scutellum.

It is more closely related to *A. pauperculus* and its relatives but differs from them by having a slightly elongate scutellum and lateral tibial carinae. *A. derifieldi* differs significantly from both *A. pullus* and *A. pauperculus* and their relatives in the structure of the male genitalia and in having very different host preferences.

The *A. longistilus* - *A. biustulus* group is most similar in overall structure to *A. derifieldi*, especially the hind leg. The elytral vestiture pattern, the male genitalia, and, of course, host plants are quite different between *A. derifieldi* and this group.

A. derifieldi is apparently confined to hosts in the genus *Desmanthus* and is not too successful in them.

This species is named for Professor Ken Derifield, Northern Arizona University, master teacher of biologists.

***Acanthoscelides desmanthi*, new species**

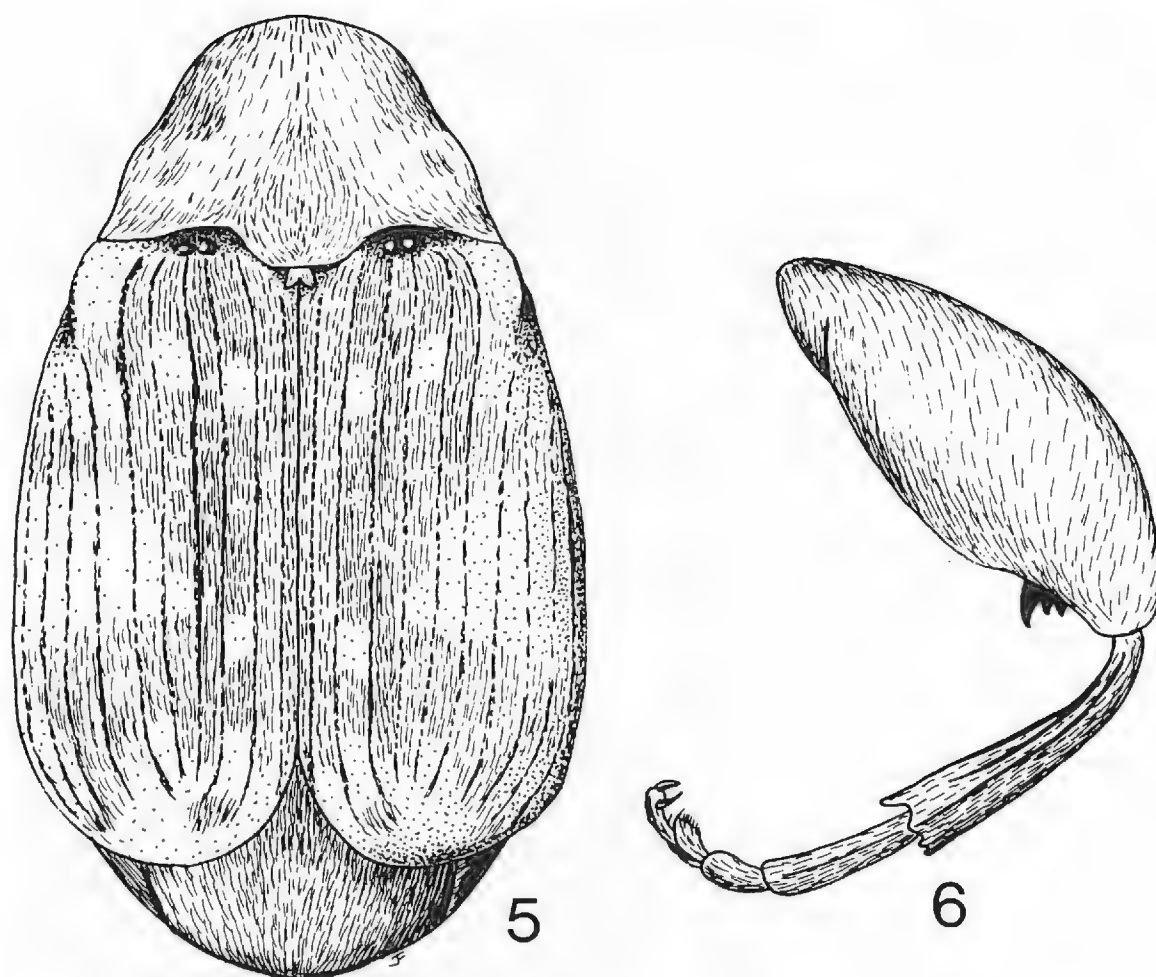
(Figs. 5-10)

Length (pronotum-elytra) 1.5-2.1mm. Width 0.9-1.2mm. Maximum thoracic depth 0.8-1.0mm.

MALE: Similar to *Acanthoscelides bisignatus* (Horn) (see Johnson 1970, p. 37) with the following exceptions: Head usually red-orange with frons and vertex black; vestiture of pronotum and elytra (fig. 5) usually more contrasting and dense than *A. bisignatus*. **Genitalia** — Figs. 7, 8. Median lobe moderately long; in ventral view, ventral valve subtriangular, lateral margins slightly concave, base about as wide as apex of median lobe; ventral valve arcuate in lateral view and perpendicular to long axis of median lobe; armature of internal sac consisting of about basal one-half lined with fine spicules, a medial clump consisting of two bands of strong spines connected to elongate strands of moderately strong spines extending toward apex; apex with about eight scattered strong, rounded spines. Lateral lobes expanded apically, cleft to about 0.9 their length (fig. 4).

FEMALE: No differences.

HOST PLANTS: *Desmanthus* spp.: Texas. Nueces Co.: Robstown, 4 July 1922 (LJB #49y6). Cameron Co.: Harlingen, 28 July 1922 (LJB #50h1); Brownsville, 8 January 1923 (LJB #51g2). Mexico. Sonora: 15 mi S Oroz, 28 January 1964 (P. M. Estes); 42 mi N Guaymas, 30 August 1965 (CDJ); Benjamin Hill, 21 December 1972 (CDJ #134-72); 13 mi E Navojoa, 25 December 1972 (CDJ #169-72); Benjamin Hill, 31 December 1975 (CDJ #159-75); 8 mi E Navojoa, 25 December 1972 (CDJ #174-72); 35 mi. SE Guaymas, 8 January 1973 (CDJ #140-73); 5 mi N Guaymas, 31 December 1975 (CDJ #155-75). Sinaloa: 19 mi N Mazatlan, 7 January 1973 (CDJ #124-73); 4 mi S Culiacan, 26 December 1972 (CDJ #182-72); 53 mi S Culiacan, 26 December 1972 (CDJ #187-72); 3 mi S Rosario, 27 February 1973 (CDJ #224-73); 14 mi S Culiacan, 7 January 1973 (CDJ #133-73); 4 mi S Culiacan, 25 February 1973 (CDJ #187-73); 26 mi S Culiacan, 25 February 1973 (CDJ #192-73). Jalisco:



Figs. 5-6, *Acanthoscelides desmanthi*: 5. habitus; 6. hind leg.

ca 4000', 15 mi W Magdalena, 2 March 1973 (CDJ #317-73). Nuevo Leon: 2 mi SE Salinas Victoria, 19 & 20 June 1964 (CDJ). Tamaulipas: 7 mi. E Ciudad Mante, 21 June 1964 (CDJ).

Desmanthus covillei (Britt. & Rose) Wiggins ex Turner: Mexico. Sonora: San Carlos Bay, 23 December 1972 (CDJ #144-72); 8 mi E Navojoa, 24 February 1973 (CDJ #175-73); 9 mi E Navojoa, 30 December 1975 (CDJ #152-75); 14 mi S Navojoa, 24 February 1973 (CDJ #180-73).

D. virgatus (L.) Willdenow: Texas. Lasalle Co.: Encinal, 4 July 1947 (LJB #88a). Mexico. Oaxaca: 6 mi E Tehuantepec, 6 July 1968 (CDJ #219-68); 2800', 53 mi NW Tehuantepec, 6 July 1968 (CDJ #224-68); 27 mi S Matias Romero, 16 June 1968 (CDJ #128-68). Chiapas: 3-5 mi W Ocozocoautla, 17 June 1968 (CDJ #142-68).

D. virgatus var. *depressus*: Texas. Cameron Co.: Brownsville, 21 September 1947 (LJB #89g).

TYPE SERIES: Holotype ♂, allotype ♀ and one paratype: Mexico. Chiapas: 3-5 mi W Ocozocoautla, 17 June 1968, reared seeds *Desmanthus virgatus*, C. D. Johnson #142-68. USNM #72782. Numerous additional paratypes listed under HOST PLANTS. Other specimens (not paratypes): Texas. Cameron Co.: Brownsville, 8 July 1941 (B. E. White); Hidalgo Co.: 20 March 1952 (D. J. & J. N. Knull). Mexico. Veracruz: 29 mi SE Jalapa, 900', 26 December 1963 (C.W. O'Brien). Guanajuato: 11 mi SW Irapuato, 6000', 21 December 1963 (C. W. & L. B. O'Brien). Sinaloa: 18 mi S. Villa Union, 31 January 1964 (P. M. Estes), 8 mi S Escuinapa, 18 December 1963 (L. B. & C. W. O'Brien). Holotype, allotype, and numerous paratypes deposited in the U. S. National Museum of Natural History, Washington, D.C. Paratypes retained in the author's collection and also deposited in the following collections: Arizona State University, Tempe; California Academy of Sciences, San Francisco; Canadian National Collection of Insects, Ottawa; Museum of Comparative Zoology,

Harvard University, Cambridge, Mass.; Texas A & M University, College Station; University of Arizona, Tucson; and the University of California, Riverside.

Acanthoscelides desmanthi is only separated consistently from *A. bisignatus* by examining the male genitalia. *A. desmanthi* has many strong spines in the internal sac (fig. 7) and its lateral lobes are cleft to about 0.9 their length (fig. 8) while the genitalia of *bisignatus* have a few moderately strong spines and the lateral lobes are cleft only for about 0.5 their length.

Externally there are no consistent features to separate these two species. Usually the head of *bisignatus* is mostly black and the head of *desmanthi* is mostly red-orange with a dark vertex and frons. The pronotal and elytral vestiture of *desmanthi* is similar in pattern to that of *bisignatus* but is usually brighter and more dense.

A. bisignatus occurs only in the United States, east of the Continental Divide and north of about 30° N latitude in Texas. This distribution generally conforms to that of *Desmanthus illinoensis*, probably its most common host. The distributions of *D. illinoensis*, *D. leptolobus*, and *D. velutinus*, its known hosts in Texas (Turner, 1959), generally match the known distribution of *A. bisignatus* in Texas. It has been collected as far west as Albuquerque, New Mexico, and as far east as Florida. I have examined the lectotype of *bisignatus* and, although it is a female, it is a member of the northern population and is a true *bisignatus*.

A. bisignatus was reported by Cushman (1911) as being reared from *D. virgatus*. Cushman almost certainly reared *A. desmanthi* from this plant because the only verified records of rearing *desmanthi* have been from *D. virgatus* and *D. covillei* while no verified rearings of *bisignatus* have been reported.

These 2 species are easily separated from other *Acanthoscelides* by the size and shape of the spines on the hind leg (fig. 6) and the sexual dimorphism of the heads of the males and females (figs. 9, 10).

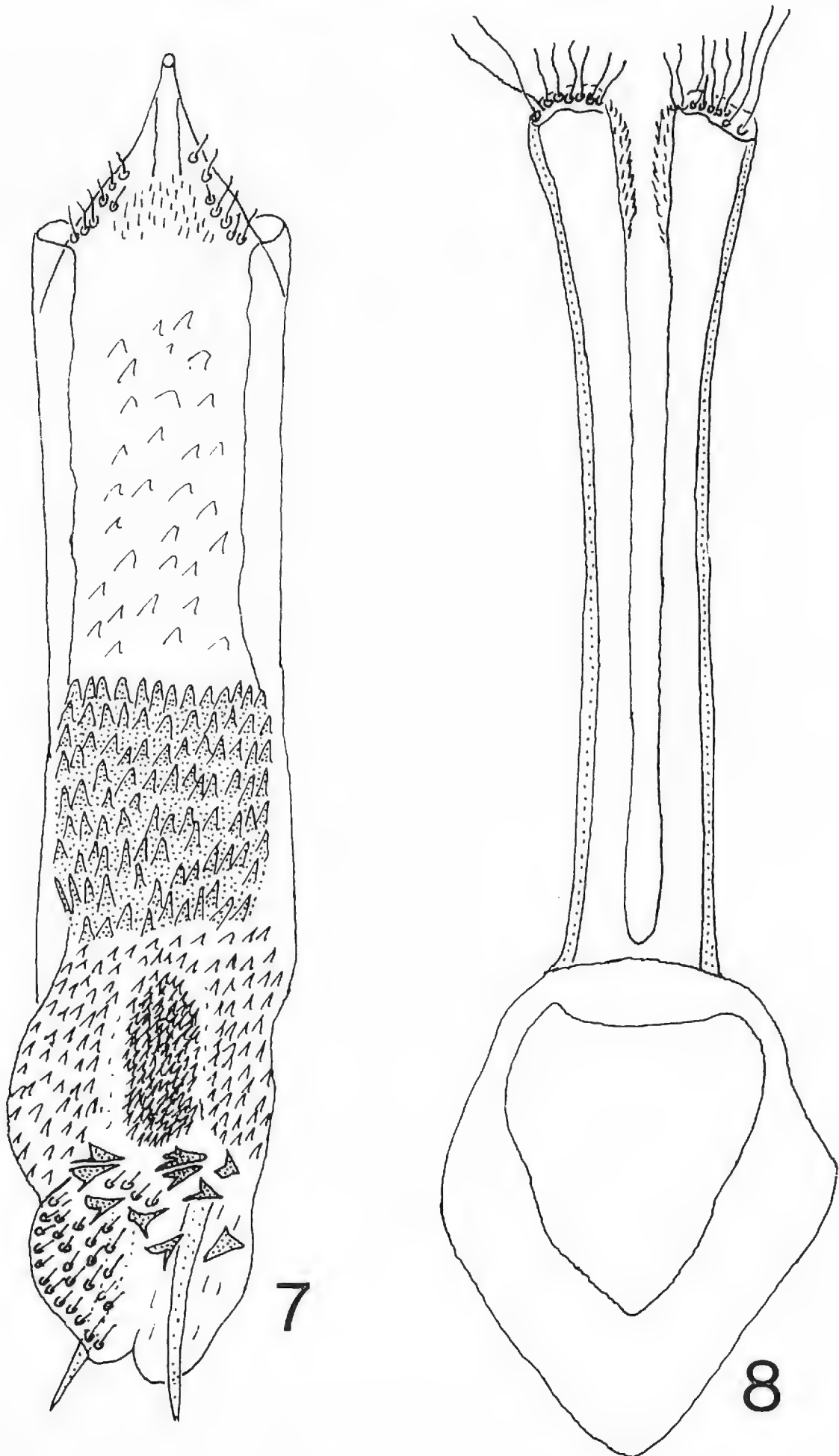
Apparently *desmanthi* and *bisignatus* are primarily allopatric with perhaps a zone of sympatry in central and possibly southern Texas but there is no evidence of hybridization. One explanation for the lack of hybridization is that they are very host specific.

The distribution of *desmanthi* is from southern Texas and northern Sonora to Chiapas, Mexico. This distribution generally matches that of *Desmanthus virgatus*, probably its most common host. *D. virgatus* has a wide distribution in the tropics and *desmanthi* most likely will be found to be associated with it more extensively with further collections.

New Host and Locality Records for Bruchids Infesting

Desmanthus and *Hoffmanseggia*

The mimosoid legume genus *Desmanthus* contains about 40



Figs. 7-8, *Acanthoscelides desmanthi* male genitalia: 7. median lobe; 8. lateral lobes.

species distributed in the warmer regions of North and South America, but a few taxa of the *Desmanthus virgatus* complex are pan-tropical (Turner, 1959). Mexico has about 20 of the world's recognized taxa (Turner, 1959). When compared with the few species infested by bruchids in other plant genera, it is surprising that about one-half of these species are known to have their seeds fed upon by bruchids (Tables 1, 2). Probably this is because few bruchid host genera have had their seeds systematically examined for bruchids.

Six species of bruchids infest species of *Desmanthus*, which is also remarkable considering the relatively small number of species in this plant genus. Of the 6 species, only *bisignatus* and *desmanthi* appear to be closely related. The other 3 species of *Acanthoscelides* are not particularly close in their morphology and the opportunistic species *Sator pruininus* is very remotely related to the species of *Acanthoscelides*.

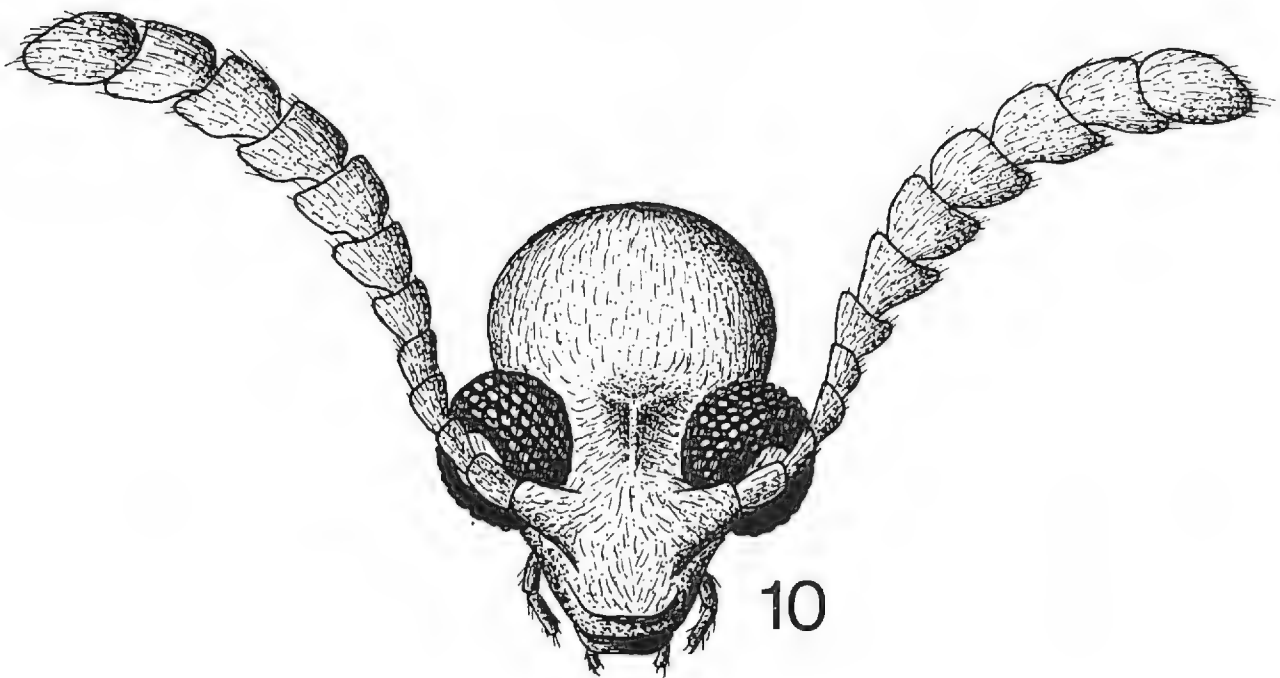
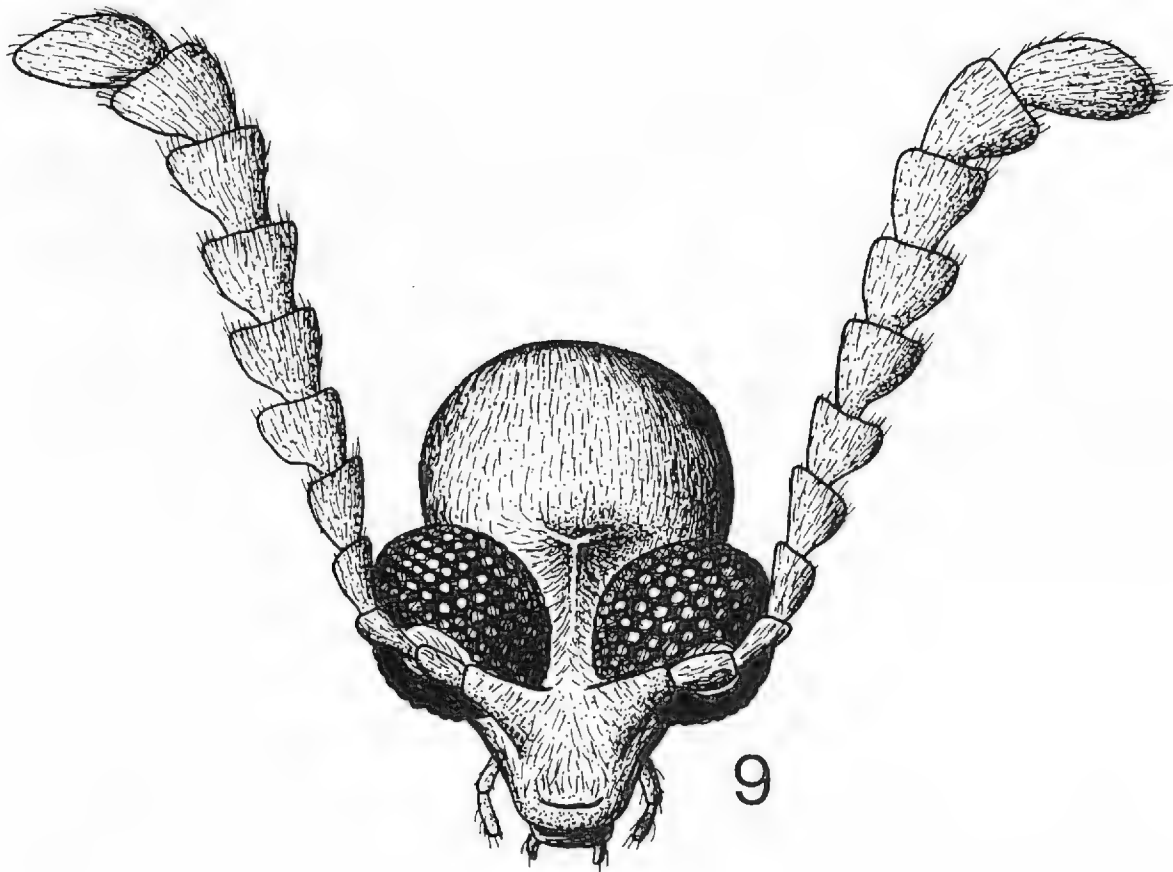
The caesalpinoid legume genus *Hoffmanseggia* contains about 30 species, mostly in dry areas of subtropical North America, South America, and South Africa (Turner, 1959). The only bruchid known to infest its seeds (Table 2) is the apparently opportunistic species *Acanthoscelides compressicornis*. It is not unusual for a bruchid to have a wide variety of hosts, but it is unusual for a bruchid with many host species to be found only in 2 genera and these genera in different subfamilies! Further studies will further elucidate the evolutionary role played by this bruchid, not only its relationships to other bruchids, but its role in the evolution of its plant hosts.

No host records have been reported in the literature for *A. pectoralis* so the 3 hosts listed below for this species are new. Ten new hosts are reported for *A. compressicornis* and 3 new records for *S. pruininus* for total of 16 for these 3 species. Because the taxonomic confusion between *A. bisignatus* and *A. desmanthi* has now been clarified, it is possible to recognize the sharp division between the host preferences of these 2 species (Tables 1, 2).

It is of interest to note here that *A. compressicornis* not only has a wide range of hosts but also has a wide geographical range. *A. desmanthi* has a wide geographical range but far fewer hosts. These phenomena are common in the species of Bruchidae and were briefly discussed by Johnson and Kingsolver (1973). Further studies will help to explain these distributional patterns of bruchids and their hosts.

Acanthoscelides bisignatus (Horn)

1. *Desmanthus illinoensis* (Michx.) MacM.: Texas. Menard Co.: Menard, 27 April 1946 (LJB #85t), 2 October 1960 (LJB #109d) and 30 July 1946 (LJB #86x). Dallas Co.: 5 mi E Dallas 15 October 1927 (LJB #54v2). Tarrant Co.: St. Francis Village, 10 August 1968 (LJB #128p). Ellis Co.: Bristol, 30 July 1959 (LJB #105c). Oklahoma: Woodward, 25 September 1954 (LJB #94p); Tulsa, September 1958 (A.P. Blair).



Figs. 9-10, *Acanthoscelides desmanthi*: 9. head, male; 10. head, female.

- 2. *D. leptolobus* Torrey & Gray: Texas. Johnson Co.: 9 mi S Cleburne, 2 August 1959 (LJB #105e).
- 3. *D. leptolobus?*: Texas. Hale Co.: Plainview, 28 December 1923 (LJB #52k8). Lubbock Co.: Lubbock, 21 December 1923 (LJB #52k4).
- 4. *D. velutinus* Scheele: Kerr Co.: Kerrville, 18 June 1947 (LJB #87x).

Acanthoscelides compressicornis (Schaeffer)

- 1. *Desmanthus* spp.: Texas. Kerr Co.: Kerrville, 8 June 1955 (LJB #94u). Kansas: Eskridge, 29 August 1947 (LJB #88q). Mexico. Sonora: Benjamin Hill, 21 December 1972 (CDJ #134-72); 35 mi SE Guaymas, 8 January 1973 (CDJ #140-73); 6 mi S Santa Ana, 8 January 1973 (CDJ #142-73); 5 mi N Guaymas, 31 December 1975 (CDJ #155-75); Benjamin Hill, 31 December 1975 (CDJ #159-75).
- 2. *Desmanthus cooleyi* (Eaton) Trel.: Arizona. Yavapai Co.: 4 mi SE Camp Verde, 10 September 1972 (CDJ #59-72). Coconino Co.: base, south slope, Mt. Elden, Flagstaff, 21 September 1972 (CDJ #69-72); 7.6 mi W Stoneman Lake, 24 August 1970 (T. D. Center); 4 mi W Stoneman Lake, 19 September 1970 (T. D. Center); 4 mi NW Flagstaff, 26 August 1970 (T. D. Center).
- 3. *Desmanthus covillei*: Mexico. Sonora: San Carlos Bay, 23 December 1972 (CDJ #144-72); 16 mi S Hermosillo, 21 August 1970 (CDJ #136-70).

Table 1. Bruchid species infesting *Desmanthus* and *Hoffmanseggia* (Supplement to Johnson, 1970, and Johnson and Kingsolver, 1976).

Bruchid	<i>Desmanthus</i> and <i>Hoffmanseggia</i> host species
(1) <i>Acanthoscelides bisignatus</i>	<i>D. illinoensis</i> <i>D. leptolobus</i> <i>D. velutinus</i>
(2) <i>A. compressicornis</i>	<i>D. cooleyi</i> <i>D. covillei</i> <i>D. depressus</i> <i>D. illinoensis</i> <i>D. leptolobus</i> <i>D. obtusus</i> <i>D. velutinus</i> <i>D. virgatus</i> <i>H. densiflora</i> <i>H. drepanocarpa</i> <i>H. tenella</i>
(3) <i>A. derifieldi</i>	<i>D. covillei</i> <i>D. subulatus</i>
(4) <i>A. desmanthi</i>	<i>D. covillei</i> <i>D. virgatus</i>
(5) <i>A. pectoralis</i>	<i>D. obtusus</i> <i>D. velutinus</i> <i>D. virgatus</i>
(6) <i>Stator pruininus</i>	<i>D. cooleyi</i> <i>D. covillei</i> <i>D. fruticosus</i> <i>D. subulatus</i>

4. *Desmanthus depressus* Humb. & Bonpl. ex Willdenow: Florida: Taverner, Key Largo, 9 April 1960 (LJB #106r).
5. *D. illinoensis* (Michx.) MacM.: Texas. Menard Co.: Menard, 30 July 1946 (LJB #86x). Caldwell Co.: Palmetto State Park, 30 June 1957 (LJB #101b). Tarrant Co.: St. Francis Village, 10 August 1968 (LJB #128p). Kerr Co.: Kerrville, 11 July 1950 (LJB #91z).
6. *D. leptolobus* Torrey & Gray: Texas. Johnson Co.: 9 mi S Cleburne, 2 August 1959 (LJB #105e).
7. *D. obtusus* S. Wats.: Texas. Menard Co.: Menard, 28 June 1946 (LJB #86e). Pecos Co.: 10 mi E Sheffield, 8 August 1961 (LJB #112i).
8. *D. velutinus* Scheele: Texas. Kerr Co.: Kerrville, 18 June 1947 (LJB #87x) and 19 July 1955 (LJB #95r). Johnson Co.: 9 mi S Cleburne, 2 August 1959 (LJB #105f). Kimble Co.: Junction, 17 June 1956 (LJB #97k). Lampasas Co.: 9 mi N Lampasas, 27 July 1959 (LJB #104y).
9. *D. virgatus*: Texas. Cameron Co.: Brownsville, 21 September 1947 (LJB #89g). La-salle Co.: Encinal, 4 July 1947 (LJB #88a). Kinney Co.: Spofford, 16 August 1959 (LJB #105v). Mexico. Oaxaca: 6 mi E Tehuantepec, 6 July 1968 (CDJ #219-68); 27 mi S Matias Romero, 16 June 1968 (CDJ #128-68). Chiapas: 3-5 mi W Ocozocoautla, 17 June 1968 (CDJ #142-68).

Table 2. *Desmanthus* and *Hoffmanseggia* and their infesting bruchids (Supplement to Johnson, 1970, and Johnson and Kingsolver, 1976).

(1) <i>Desmanthus cooleyi</i>	<i>Acanthoscelides compressicornis</i> <i>Stator pruininus</i>
(2) <i>D. covillei</i>	<i>A. compressicornis</i> <i>A. derifieldi</i> <i>A. desmanthi</i> <i>S. pruininus</i>
(3) <i>D. depressus</i>	<i>A. compressicornis</i>
(4) <i>D. fruticosus</i>	<i>S. pruininus</i>
(5) <i>D. illinoensis</i>	<i>A. bisignatus</i> <i>A. compressicornis</i>
(6) <i>D. leptolobus</i>	<i>A. bisignatus</i> <i>A. compressicornis</i>
(7) <i>D. obtusus</i>	<i>A. compressicornis</i> <i>A. pectoralis</i>
(8) <i>D. subulatus</i>	<i>A. derifieldi</i> <i>S. pruininus</i>
(9) <i>D. velutinus</i>	<i>A. bisignatus</i> <i>A. compressicornis</i> <i>A. pectoralis</i>
(10) <i>D. virgatus</i>	<i>A. compressicornis</i> <i>A. desmanthi</i> <i>A. pectoralis</i>
(11) <i>Hoffmanseggia densiflora</i>	<i>A. compressicornis</i>
(12) <i>H. drepanocarpa</i>	<i>A. compressicornis</i>
(13) <i>H. tenella</i>	<i>A. compressicornis</i>

10. *D. virgatus* var. *depressus*: Texas. Harris Co.: Houston, 2 July 1948 (J. L. Ward, LJB #91f3).
11. *Hoffmanseggia densiflora* Benthams ex Gray: Texas. Reeves Co.: 25 mi SE Pecos, 8 August 1961 (LJB #112h). New Mexico. Dona Ana Co.: U.S. 80 near White Sands, 7 August 1961 (LJB #112d).
12. *Hoffmanseggia drepanocarpa* Gray: Arizona. Yavapai Co.: 3.5 mi N Camp Verde, 14 & 22 June 1970 (T. D. Center); 3 mi E Drake, 6 June 1972 (CDJ #27-72). New Mexico. Luna Co.: near Deming, 24 September 1947 (O. G. Babcock).
13. *H. tenella* Tharp & Williams: Texas. Nueces Co.: Robstown, 28 July 1922 (LJB #50f3).

Acanthoscelides pectoralis (Horn)

1. *Desmanthus* spp.: Texas. Cameron Co.: Harlingen, 28 July 1922 (LJB #50h1). Kerr Co.: Kerrville, 8 June 1955 (LJB #94u). Nueces Co.: Robstown, 4 July 1922 (LJB #49y6). Mexico. Nuevo Leon: 2 mi SE Salinas Victoria, 19 & 20 June 1964 (CDJ).
2. *Desmanthus obtusus*: Texas. Menard Co.: Menard, 28 June 1946 (LJB #86e).
3. *D. velutinus*: Texas. Kerr Co.: Kerrville, 18 June 1947 (LJB #87x) and 19 July 1955 (LJB #95r). Lampasas Co.: 9 mi N Lampasas, 27 July 1959 (LJB #104y). Johnson Co.: 9 mi S Cleburne, 2 August 1959 (LJB #105f). Chalk Mt., 2 August 1959 (LJB #105g).
4. *D. virgatus*: Texas. Cameron Co.: Brownsville, 21 September 1947 (LJB #89g).

Stator pruininus (Horn)

1. *Desmanthus* spp.: Mexico. Sinaloa: 4 mi S Culiacan, 26 December 1972 (CDJ #182-72). Sonora: 5 mi N Guaymas, 31 December 1975 (CDJ #155-75); Benjamin Hill, 31 December 1975 (CDJ #159-75).
2. *Desmanthus cooleyi*: Arizona. Pima Co.: ca. 4500', mouth, Madera Canyon, 14 October 1976 (CDJ #53-76). Santa Cruz Co.: ca. 4200', 6 mi E Ruby, 15 October 1976 (CDJ #64-76).
3. *Desmanthus covillei*: Mexico. Sonora: 9 mi E Navojoa, 30 December 1975 (CDJ #152-75).
4. *D. fruticosus*: Mexico. Baja California Sur: 4 mi E Cabo San Lucas, 27 December 1975 (CDJ #125-75); 4 mi W San Jose Del Cabo, 27 December 1975 (CDJ #133-75).
5. *D. subulatus*: Mexico. Baja California Sur: 9 mi S Villa Constitucion, 25 December 1975 (CDJ #103-75).

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BOOK REVIEW

Survey of the World's Aphids. V. F. Eastop & D. Hille Ris Lambers. 1976. Dr. W. Junk b.v. P.O. Box 1713. The Hague, The Netherlands. 586 pp. Cloth. Dutch Guilders 160. —

This is an important book. Two of the world's foremost authorities on aphids have pooled their scholarship to produce a book that will make it easier to know the aphids. This book is a survey of described aphids in which the authors list all the scientific names proposed for aphids. Each species is assigned to its correct genus and subgenus according to their opinions, with which most aphid authorities in western Europe, North and South America, Australia, New Zealand, India, Taiwan, and Japan agree. First, all the genera are enumerated in alphabetical order with their type species, synonyms, and all the species originally or subsequently validly placed in them, with their synonyms. Secondly, an alphabetical list is given of all specific names, each followed by the names of the genera in which the species originally were described, of which the species was the type species, and in which they now occur.

This book should make it easier to find the correct name for an aphid, and to understand which aphid an author has in mind when he uses a scientific name. The increase in transportation speed and the partial breakdown of plant quarantines has resulted in more rapid dispersal of aphid species. For instance, we have found about one newly arrived aphid species in California each recent year. It is urgent that these newly arrived aphids be identified quickly so that search for biological control agents can be made where the aphid is indigenous.

The book is printed clearly and strongly bound to withstand the hard use that some copies will receive. I have found no errors. — R. C. DICKSON *Professor of Entomology, Emeritus, University of California, Riverside, CA 92502.*

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PROCEEDINGS

THREE HUNDRED AND SIXTY-NINTH MEETING

The 369th meeting was held 23 January 1976 in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 42 members and 19 visitors present.

The minutes of the meeting held 19 December 1975 were summarized.

Dr. Thomas D. Eichlin was elected to regular membership.

Under notes and exhibits:

Robert Lem reported on a biological transplant of cave insects to a new cave in Calaveras County.

Baldomero Villegas reported on a genus and species of Mecoptera new to California from Placer and El Dorado Counties.

The main speaker of the evening was **Dr. Donald L. Dahlston**, who presented an illustrated talk entitled, "Perspectives on Forest Insects in California."

Refreshments were served in the Trustees Room after the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTIETH MEETING

The 370th meeting was held 20 February 1976 in the Morrison Auditorium, California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 39 members and 21 visitors present.

The minutes of the meeting held 23 January 1976 were summarized.

The following members were elected to membership. Student membership: Kent Brittan, Gary Glidden, Steven Cornes, J. H. Diaz de Arce, Richard P. Meyer, Richard Kawin, Donald S. Starks, and Charles Griswold. Regular membership: Stanley Kuba, Dr. Velma K. Mayo, and David E. Ruiter.

The members present indicated by hand vote they would be interested in having a dinner meeting at the April meeting to celebrate our 50th anniversary.

Dr. Arnaud announced that the new Entomology rooms are now open. Dr. Kavanaugh will conduct a short tour of the facilities.

ROBERT GRANT WIND (1912-1975). — Robert Grant Wind, who was born in San Francisco on June 17, 1912 died in Guatemala on July 4, 1975. He was raised in Berkeley and attended the University of California in that city between 1930 and 1933. He operated the Pacific Coast Biological Company in Berkeley from 1933 to 1937. From 1938-1940 he organized the "Papuan-Australian Expedition" and accompanied by his wife Clo Wind (nee Mifflin) collected in New Guinea, the former Dutch East Indies, and Australia, reportedly collecting a quarter million specimens of insects. Subsequently he was in business selling entomological specimens, wholesale shells, native carvings and artifacts, and entomological equipment and operated several gift shops in Monterey and Carmel. From 1965 on he lived in Mexico doing a great deal of field work and was involved in the sale of butterflies and other insects. On display, after the meeting, in the Department of Entomology, is his collection of Western American butterflies assembled in the 1930's and '40's. These have, within the past month, been transferred to the Academy from Pacific Grove by Mr. Thomas W. Davies. The collection, which numbers over 3,700 specimens, was obtained for the Department by a donation from Mr. Donald Patterson. Among the many species represented are the type series of *Megisto rubricata smithorum* Wind, *Minois meadii melania* Wind and *Neonympha henshawi texana* Wind, 14 specimens of the extinct *Glaucopsyche xerces* (Boisduval) and its forms from San Francisco as well as 8 specimens of the rare or possibly extinct *Speyeria adiastra atossa* (Edwards) from the Tehachapi Mountains. Society records show that Robert Wind was a member of the

Pacific Coast Entomological Society for three years — 1931, 1932, and 1946. — PAUL H. ARNAUD, JR., *California Academy of Sciences, San Francisco, CA 94118*.

The main speaker of the evening was **Mr. Raymond Gill**, Systematic Entomologist, California Department of Food and Agriculture, who presented an illustrated talk entitled "Scales and mealybugs of California."

Refreshments were served in the Entomology Rooms following the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-FIRST MEETING

The 371st meeting was held Friday, 19 March 1976, in the Morrison Auditorium, California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 14 members and 33 visitors present.

The minutes of the meeting held 20 February 1976 were summarized.

The following new members were elected. Student membership: Charles Griswold, Judith Gutzka, Grieg A. Sayre, Laurel J. Wilcox, Daniel K. Young. Regular membership: J. Steven Tebbets.

President Andrews announced that the annual picnic will be held in Frank Raines County Park, Stanislaus County, 24 April 1976.

A dinner meeting to celebrate the 75th anniversary of the Society is tentatively set for October 1976 in the Steinhart Aquarium.

Baldo Villegas exhibited slides of a Mecoptera found on mosses growing on boulders in High Sierra snow melts.

TROGONOPTERA TROJANA (STAUDINGER). — On display this evening in the Lepidoptera collection area is a drawer with a dozen male specimens of the rare *Trogonoptera trojana* (Staudinger). This beautiful birdwing was first made known to science in 1889 and occurs only on the island of Palawan in the Philippine Islands. Karl Jordan, in writing of this species in Seitz (English Edition, 1927) commented that this species was rare in collections since "A sojourn on this island is very unpleasant and dangerous, . . ." These are the first specimens to become part of the California Academy of Sciences collection, and are a gift from Mr. Thomas W. Davies. The majority of the specimens were collected at Puerto Princesa, in the months of November 1973 and February 1974. — PAUL H. ARNAUD, JR., *California Academy of Sciences, San Francisco, CA 94118*.

James Tobler also commented on his experiences collecting these birdwing butterflies and other insects on Palawan in 1970.

Hugh Leech exhibited specimens of a diurnal moth, *Saturnia mendocino* Barrens, which seemed to be attracted to the tires on his car at Angwin, Napa County, CA. President Andrews related a similar incident with hydrophilids and Hister beetles being attracted to his car radiator.

The main speaker of the evening was **Dr. Edward S. Ross**, California Academy of Sciences. His illustrated talk was entitled, "Insects of the Amazon, Venezuela and Panama."

Refreshments were served in the Entomology rooms following the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-SECOND MEETING

The 372nd meeting was the annual field trip and picnic, held Saturday, 24 April 1976, at Arroyo Seco Camp, west of King City, California, with an estimated 50 persons in attendance. This was a joint meeting with the San Jose State University Entomology Club. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-THIRD MEETING

The 373rd meeting was held Friday, 24 September 1976, in the Morrison Auditorium, California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 27 members and 40 guests present.

The minutes of the meetings held 19 March 1976 and 24 April 1976 were summarized.

The following persons were elected to membership. Regular membership: Robert J. Lyon and Rodney Parrott. Student membership: William G. Lehmann and John L. Neff.

On behalf of the Executive Committee, President Andrews announced that membership fees will be raised to \$12.00 for regular members and to \$7.00 for student members beginning with the first issue of Volume 53 of the Journal, effective 1 January 1977.

The October meeting will be a Chinese dinner held in the Steinhart Aquarium and catered by the Great Wall.

James Tobler I discussed his collecting activities in Queensland, Australia in 1959 and exhibited specimens of *Papilio ullyses*.

Dr. Ed Smith exhibited slides of drawings of the internal and external morphology of primitive arthropods.

The main speaker of the evening was **Dr. Loren Anderson**, Department of Entomology, University of California, Riverside. His illustrated talk was entitled "Entomological experiences in Australia and New Zealand."

Refreshments were served in the Trustees Room following the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-FOURTH MEETING

The 374th meeting was held 22 October 1976 in the Morrison Auditorium, California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 43 guests and 60 members present.

The minutes of the meeting held 24 September 1976 were summarized.

The following persons were elected to student membership: Helen Cox, Val R. Landwehr and Paula Buickerood.

Dr. Ed Smith exhibited more slides of arthropod morphology, which link so-called primitive insects with non-insect arthropods.

Dr. Gordon Edwards exhibited slides of the Gypsy moth, *Lymantria dispar* (L.) and the extensive damage it causes in the forests of the eastern United States. This moth was recently discovered again in California in San Jose.

President Andrews expressed appreciation to all those persons who assisted with the arrangements of the dinner commemorating the 75th anniversary of the Society.

The main speaker of the evening was **Dr. Evert I. Schlinger**, Department of Entomology and Parasitology, University of California, Berkeley. His illustrated talk was entitled, "The Inglenook Fen ecosystem and problems at conservation."

Refreshments were served in the Trustees Room following the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-FIFTH MEETING

The 375th meeting was held Friday, 19 November 1976, in the Morrison Auditorium, California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 39 members and 33 guests present.

Three new members were elected. Family membership: Evelyn Joyce Zhovreboff. Regular membership: Pamela J. Ringhoff and Carl Haskins.

The minutes of the meeting of 22 October 1976 were summarized.

President Andrews commented that the dinner held last meeting was enjoyed by 105 people and receipts showed a net profit of \$23.96, which will be put into the refreshment fund.

OBSERVATIONS ON A NEW ASILID FROM RIO VISTA DUNES. — On 7 August 1976, I collected a previously undescribed robber fly in the Rio Vista area of California. The Rio Vista dunes are situated northeast of Suisun Bay, along the Sacramento River. This area of sand dunes and sparse scrubby vegetation supports a large number of insect species. Probably the most abundant and conspicuous are the bembicine sandwasps. Less conspicuous are the smaller insects which are well camouflaged by the sand or vegetation. Among these insects are the small robber flies of the genus *Stichopogon*. These tiny pirates are fairly common along sandy streams and creekbeds in dryer areas. When motionless, the flies are very difficult to see and are closely associated with small pieces

of wood and nearby vegetation. The flies in this genus are characterized by their small size and by their very broad frons. Most are covered with gray or silver pollen on the thorax and abdomen. This new species will be described elsewhere. One individual was observed to have a small mite lodged on its proboscis, but the mite dropped off when the specimen was captured. The weather was somewhat overcast, and each time a cloud passed the asilids ceased their activity. When the sun again appeared, short foraging flights were resumed, each initiated from a small piece of wood. — L. G. BEZARK, SAN JOSE STATE UNIVERSITY.

Hugh Leech reported on the apparent resistance of some tenebrionid beetles, collected near Angwin, California, to the effects of an otherwise effective cyanide killing jar. The prolonged resistance to death was attributed to lowered body metabolism, since the beetles were found hibernating in a rotting log. Some of the beetles remained alive in the cyanide jar up to 18 days.

The main speaker of the evening was **Dr. Jerry A. Powell**, Department of Parasitology and Entomology, University of California, Berkeley. This illustrated talk was entitled, "Prolonged diapause in Yucca Moths."

Refreshments were served in the Entomology Rooms following the meeting. — F. Ennik, Secretary.

THREE HUNDRED AND SEVENTY-SIXTH MEETING

The 376th meeting was held 17 November 1976 in the Morrison Auditorium of the California Academy of Sciences, Golden Gate Park, San Francisco, President Andrews presiding, with 26 members and 13 guests present.

The minutes of the meeting held 19 November 1976 were summarized.

The following persons were elected to membership. Family membership: Stephanie Ferguson and Alice Edwards. Student membership: Frank G. Zalom. Regular membership: Robert J. Lyon, Robert Oetting, Bruce W. Hagen and Barbara Henry.

On behalf of the Auditing Committee, composed of Edward S. Ross and H. Vannoy Davis, Dr. Arnaud summarized the financial statement of the Society. Income is derived from dues and subscriptions, page charges, sales of Memoirs and back issues of journals, saving accounts interest, and dividends from stocks. The financial statement is published here in order for all members to know the financial condition of the Society.

Dr. Arnaud stated that the treasurer's office is indebted to Mrs. V. Hawley, former Office Manager of the Academy, for her dedicated attention to the Society's billings and accounts, now on a volunteer basis, and to Mrs. Lynn Chivers for similar work, to Mrs. Gail Freihofer, Entomology Secretary, for her attention to many letters and mailings of Society publications, and to Mr. H. Vannoy Davis, member of the firm of J. K. Lasser and Company (Certified Public Accountants), not only for his review of the Treasurer's records, but also for the completion of our Federal and State Income Tax Forms.

Although not announced, President Andrews appointed R. E. Somerby and R. M. Bohart to the Publication Committee for 1977 through 1979, to replace retiring members J. G. Edwards and C. B. Philip.

On behalf of the Nominating Committee, composed of T. N. Seeno, E. I. Schlinger, and K. S. Corwin, Ms. Corwin presented the 1977 slate of candidates for office in the Society: President: Ronald E. Stecker; President-elect: Charles Daily; Secretary: Larry Bezark; Treasurer: Paul H. Arnaud, Jr. There were no nominations from the floor. The candidates were elected to office in the Society for 1977 by unanimous vote.

DIURNAL FLIGHT ACTIVITY OF *AUTOGRAPHA CALIFORNICA* (SPEYER) (LEPIDOPTERA: NOCTUIDAE) IN CENTRAL CALIFORNIA, AUTUMN, 1976. — The Alfalfa Looper, *Autographa californica* (Speyer) is one of the commoner Plusiinae found in California. Essig (1926, *Insects of Western North America*, p. 687) comments that it "appears in the spring and throughout the summer, and visits flowers at dusk and the early part of the night." Eichlin (1975, *Occasional Papers in Entomology*, State of California, Department of Food and Agriculture, no. 21, p. 22) reports that the species may be found flying somewhere in the State [California] all year round." In the fall of 1976, both authors of this note have found it to be conspicuously present in their own gardens — in South San

Francisco and San Leandro — as well as on sand dunes at Pacific Grove. Some days and evenings in October and early November during this drought period have been especially warm and mild, and this may in part account for its flight activity and our observations of it.

Davies at San Leandro found adults of *A. californica* abundant at the end of October and in early November during mid-day (in bright sunshine) to dusk visiting at the blossoms of two orange trees in his back yard. A dozen could be observed at one time. They would fly high — at a height of about 5 meters — from a westerly direction. During this same period, Arnaud in South San Francisco observed this species flying at dusk in his small front garden, where up to half a dozen at one time were visiting the blossoms of the introduced garden ornamental — *Hebe X franciscana* (Eastw.) Souster (family Scrophulariaceae; determined by Dr. Elizabeth McClintock). Four specimens were collected — one on November 3rd and three on November 5th as voucher specimens.

On a joint collecting trip to Pacific Grove on November 7th, we found *A. californica* flying abundantly over the sand dunes along the Asilomar State Beach. Between 1300 and 1500 hours on a sunny, warm, almost windless day, we observed it actively visiting plants in bloom. These included the purple flowered Seaside Daisy, *Erigeron glaucus* (Ker.) and a yellow flowered *Lotus* sp. It preferred the *Lotus*. The projected Kodachrome slides show it at these flowers. In contrast, *Pieris protodice* Boisduval and Le Conte was common in the same areas and preferred the flowers of the *Erigeron*. — P. H. ARNAUD, JR. and T. W. DAVIES, *California Academy of Sciences, San Francisco, CA 94118*.

BUTTERFLIES AT MUD PUDDLE SEGREGATE INTO TAXONOMIC GROUPS. — Kodachrome slides showing butterflies that aggregated by species (9 *Papilio cressphontes*, 5 *Achylodes thraso*, and 3 *Leptotes marinus*), subfamily (Pyrginae: 12 *Pyrgus* and *Heliopetes* of 3 species) and family (Pieridae: 8 *Phoebis* and *Eurema* of a species) within 2m² around a puddle on a muddy road were exhibited. The photos were taken near Villagran, Tamaulipas, Mexico, in September 1976, between 1200 and 1230 C.S.T. During that time, the butterflies were dispersed many times by human and domestic animal traffic, each time returning to form the same discrete groupings, usually at the same spots. Individuals of *Microtia elva* (Nymphalidae) were scattered, in part intermingled with one or more of the other groups. One white *Eurema daira* associated itself with the white pyrgines rather than with the yellow pierids. — J. A. POWELL, *University of California, Berkeley*.

The main speaker of the evening was Dr. Fred G. Andrews, Systematic Entomologist, California Department of Food and Agriculture, Sacramento. His Presidential address was entitled, "Coleoptera of western sand dunes, both threatened entities."

Refreshments were served in the Entomology Rooms following the meeting. — F. Ennik, Secretary.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

STATEMENT OF INCOME, EXPENDITURES AND
CHANGES IN FUND BALANCES*Years Ended September 30, 1976 and 1975*

	<u>1976</u>	<u>1975</u>
Income		
Dues and subscriptions.....	\$ 7,027	\$ 5,728
Reprints and miscellaneous	7,206	6,700
Sales of memoirs	463	640
Interest on savings accounts	979	1,019
Dividends, American Telephone & Telegraph Co.	288	
Increase in value of capital stock of American Telephone & Telegraph Co.....	<u>1,140</u>	<u>390</u>
	<u>17,103</u>	<u>14,749</u>
Expenditures		
Publication costs - Pan Pacific Entomologist.....	11,430	14,748
Memoirs.....		291
Reprints, postage and miscellaneous.....	<u>2,714</u>	<u>2,939</u>
	<u>14,144</u>	<u>17,978</u>
Increase (decrease) in fund balances	2,959	(3,229)
Fund balances October 1, 1975 and 1974	<u>23,610</u>	<u>26,839</u>
Fund balances September 30, 1976 and 1975.....	<u>\$26,569</u>	<u>\$23,610</u>

STATEMENT OF ASSETS

September 30, 1976 and 1975

	<u>1976</u>	<u>1975</u>
Cash in bank		
Commercial account.....	\$ 1,610	\$ 770
Savings accounts		
General fund.....	12,649	12,035
Memoir fund.....	2,714	2,582
Fall fund	2,655	2,526
Life membership fund	<u>2,131</u>	<u>2,027</u>
Total cash in bank	21,759	19,940
Investment in 80 shares of American Telephone & Telegraph Co. common stock (Life Membership and Fall Funds), at market value.....	<u>4,810</u>	<u>3,670</u>
Total.....	<u>\$26,569</u>	<u>\$23,610</u>

See accompanying notes to the financial statements.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

NOTES TO THE FINANCIAL STATEMENTS

Year Ended September 30, 1976

SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Accounting Method

Income, expenditures and assets are recorded on the cash basis of accounting.

Marketable Securities

American Telephone & Telegraph Co. common stock is carried at market value. Increases and decreases in value are reflected in income.

Income Tax

The Company is exempt from Federal income and California franchise tax.

Accounts Receivable

As of September 30, 1976 accounts receivable aggregated \$1,102 as follows:

August and September, 1976 billings.	\$ 19
June and July billings	933
Prior billings	150
	<u>\$1,102</u>

As Chairman of the Auditing Committee, and in accordance with its by laws, I have reviewed the financial records of the Society.

During the course of this review nothing was noted which indicated any inaccuracy in the foregoing statements.

H. VANNOY DAVIS
Chairman of the Auditing Committee

THE PAN-PACIFIC ENTOMOLOGIST
Information for Contributors

Papers on the systematic and biological phases of entomology are favored, including short notes or articles up to *ten* printed pages, on insect taxonomy, morphology, behavior, life history, and distribution. Excess pagination must be approved and *will* be charged to the author. Papers are published after acceptance in approximately the order that they are received. Papers of less than a printed page will be published as space is available, in **Scientific Notes**.

All manuscripts will be reviewed *before acceptance*.

Manuscripts for publication, proofs, and all editorial matters should be addressed to the editor.

General. — The metric system is to be used exclusively in manuscripts, except when citing label data on type material, or indirect quotations when cited as such. Equivalents in other systems may be placed in parentheses following the metric, *i.e.* "1370 m (4500 ft) elevation".

Typing. — **Two copies** of each manuscript must be submitted (original and one xerox copy or two xerox copies are suitable). All manuscripts must be **type-written, double-spaced** throughout, with ample margins, and be on bond paper or an equivalent weight. **Carbon copies** or copies on paper larger than 8½ x 11 inches are not acceptable.

Underscore only where *italics* are intended in the body of the text. **Number all pages** consecutively and put authors name on each sheet. References to **footnotes** in text should be numbered consecutively. Footnotes **must** be typed on a separate sheet.

Manuscripts with extensive corrections or revisions will be returned to the author for retyping.

First Page. — The page preceding the text of the manuscript must include (1) the complete title, (2) the order and family in parentheses, (3) the author's name or names, (4) the institution with city and state or the authors home city and state if not affiliated (5) the complete name and address to which proof is to be sent.

Names and descriptions of organisms. — The first mention of a plant or animal should include the full scientific name with the author of a zoological name *not* abbreviated. Do not abbreviate generic names. Descriptions of taxa should be in telegraphic style. The International code of Zoological Nomenclature must be followed.

Tables. — Tables are expensive and should be kept to a minimum. Each table should be prepared as a line drawing or typed on a separate page with heading at top and footnotes below. Number tables with Arabic numerals. Number footnotes consecutively for each table. Use only horizontal rules. Extensive use of tabular material requiring typesetting may result in increased charges to the author.

Illustrations. — No extra charge is made for the line drawings or halftones. Submit only photographs on glossy paper and original drawings. Authors *must* plan their illustrations for reduction to the dimension of the printed page (105 x 175 mm; 4-1/8 x 6-3/4 inches). If possible, allowance should be made for the legend to be placed beneath the illustration. Photographs should not be less than the width of the printed page. Photographs should be mounted on stiff card stock, and bear the illustration number on the face.

Loose photographs or drawings which need mounting and/or numbering are not acceptable. Photographs to be placed together should be trimmed and abut when mounted. Drawings should be in India Ink, or equivalent, and at least twice as large as the printed illustration. Excessively large illustrations are awkward to handle and may be damaged in transit. It is recommended that a metric scale be placed on the drawing or the magnification of the *printed* illustration be stated in the legend where applicable. Arrange figures to use space efficiently. Lettering should reduce to no less than 1mm. *On the back of each illustration* should be stated (1) the title of the paper, (2) the author's complete name and address, and (3) whether he wishes the illustration returned to him. Illustrations not specifically requested will be destroyed. **Improperly prepared illustrations will be returned to the author for correction prior to acceptance of the manuscript.**

Figure legends. — Legends should be typewritten double-spaced on separate pages headed EXPLANATION OF FIGURES and placed following LITERATURE CITED. Do not attach legends to illustrations.

References. — All citations in text, *e.g.*, Essig (1926) or (Essig 1958), must be listed alphabetically under LITERATURE CITED in the following format:

Essig, E.O. 1926. A butterfly migration. *Pan-Pac. Entomol.*, 2:211-212.

Essig, E.O. 1958. Insects and mites of western North America. Rev. ed. The Macmillan Co., New York, 1050 pp.

Abbreviations for titles of journals should follow the list of *Biological Abstracts*, 1966, 47(21):8585-8601. For **Scientific Notes** the citations to articles will appear within the text, *i.e.* . . . "Essig (1926, *Pan Pac. Entomol.*, 2:211-212) noted . . .".

Proofs, reprints, and abstracts. — Proofs and forms for the abstract and reprint order will be sent to authors. Major changes in proof will be charged to the author. Proof returned to the editor without the abstract will not be published.

Page charges. — All regular papers of one to ten printed pages are charged at the rate of \$18.00 per page. Private investigators or authors without institutional or grant funds may apply to the society for a grant to cover a portion of the page charges. In no case will society grants subsidize more than two thirds of the cost of page charges. Individuals receiving a society subsidy thus will be billed a minimum of \$6.00 per page. Pages additional to the first ten are charged at the rate of \$30.00 per page, without subsidy. Page charges are in addition to the charge for reprints and do not include the possible charges for extra pagination or the costs for excessive changes after the manuscript has been sent to the printer.

Reprint costs. — Current charges for reprints are approximately as listed below. These charges are subject to change, and authors will be billed at the rate in effect at the time of publication.

	1-2pp	2½-4 pp	4½-8 pp	8½-12 pp	12½-16 pp
1st 100	21.75	30.25	37.25	67.35	72.65
Additional 100's	11.75	16.25	23.25	34.50	39.10

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